A CROSS-SECTIONAL PERFORMANCE ANALYSIS AND PROJECTION OF THE UFC ATHLETE

UFC PERFORMANCE INSTITUTE

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VOLUME **TWO**

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The Cross-Sectional Performance Analysis and Projection of the UFC Athlete: Volume Two represents the most contemporary and comprehensive collection of philosophical insights, performance data and training methodology for the sport of MMA. The information presented here reflects knowledge and information that has been gained in supporting more than 600 world-class UFC fighters across three years, detailing the methods that have been established for supporting the world's best fighters, with proven results. The UFC Performance Institute has had the pleasure of supporting more than 75 percent of the UFC roster, as well as the development athletes in our UFC Academy, collecting thousands of data points and seeking to establish the best methods and systems for the sport of MMA. The purpose of the UFC Performance Institute is to help every fighter that has walked through its doors achieve success and fulfill his or her individual potential, as well as every up-and-coming prospect who hopes to one day compete at the highest level. In creating the blueprint for modern MMA by laying the framework for a professional and scientific approach to MMA training, development and performance, the UFC Performance Institute hopes to continue to accelerate the evolution of the world's most demanding and exciting sport.

Of course, there are many individuals who help us to succeed in delivering the world's foremost high-performance model for combat sports athletes, and we would like to acknowledge their continued support here.

- To every UFC fighter, past and present, who has trusted the UFC Performance Institute to be part of his or her career and life and has placed faith in our services and expertise. The UFC Performance Institute truly values the extent to which you allow us to serve you and play a small part in preparing you and helping your development for the world's most demanding sporting arena.
- To all the MMA coaches and trainers who allow us to play a role in serving their fighters in whatever way necessary. Your continued faith that our services can provide support and a competitive advantage to your athletes is our raison d'etre.
- To the global MMA community, including those from MMA media, regulators, support services and the fans, we share a common passion for the world's greatest sport. Your continued support is always appreciated.
- Performance specialists and professional colleagues from sports all around the world. As our peers, you interrogate our work and drive us to innovate and be better every day. Your collaborations are invaluable as we all seek to elevate and optimize human performance and athletic potential.
- To Ari Emanuel (Endeavor Co-Chief Executive Officer) and to Mark Shapiro (Endeavor President) who continually set the standard for innovation and challenge us daily to be "best in class" in all that we do.
- And lastly, but most importantly, to our fearless and inspirational leaders within the UFC executive team, without whom none of this would be possible. To Dana White (UFC President), to Lawrence Epstein (UFC Chief Operating Officer) and to Andrew Schleimer (UFC Chief Financial Officer): thank you for your vision and continuing to inspire us to position the UFC Performance Institute at the forefront of global sports performance.

— The UFC Performance Institute Team




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INTRODUCTION

"ABSORB WHAT IS USEFUL. DISCARD WHAT IS USELESS. AND ADD WHAT IS SPECIFICALLY YOUR OWN."
BRUCE LEE

Owing to the complexity of mixed martial arts (MMA) and the multitude of factors that must be considered in order to succeed (e.g., technical skills, training load, diet and making weight, competition readiness, injury mitigation), fighters and coaches are presented with a complex performance puzzle that can be challenging to solve. Add to this the nuance of stylistic preferences, fighter match-ups, fight-camp timeframes and the tactical strategies that are created to gain competitive advantage, and suddenly the amount of variables that must be considered in this most chaotic of sports can become somewhat overwhelming.

Questions that MMA fighters must constantly consider (note: not an exhaustive list):

— "How do I distribute my training sessions throughout the week?"
— "What's the best way to manage my weight cut?"
— "What should I do when I travel overseas to fight?"
— "How do I work around an injury to make sure I can compete?"

Therefore, in an effort to bring clarity and share the most contemporary approaches to train and prepare MMA fighters, the UFC Performance Institute presents the Cross-Sectional Performance Analysis and Projection of the UFC Athlete: Volume Two. Three years after the inaugural Volume One was released to the global MMA community, Volume Two provides five times more information with updated data and findings, as well as the addition of comprehensive MMA technical and tactical considerations from world-class MMA coaches affiliated with the UFC PI Academy.

The sole purpose of this journal remains the same as when it was first conceptualized with Volume One: to provide essential information that coaches' and athletes can employ and utilize within their training and competition preparation for the world's most demanding sport. Our aim is to provide valuable insights and information that will help athletes, coaches and other performance-support professionals navigate through the anecdotal "white noise" of ineffective training methodologies that often surround the technical and physical preparation of combat athletes. Instead, we aim to share the most up-to-date data and information in the hope that it can be used to inform a more strategic approach to optimize performance in the sport of MMA. Furthermore, our intention is to provide validated approaches that provide flexibility and freedom of interpretation, such that coaches and athletes alike can tailor the information to best support their own specific needs, methods and ambitions.

The core mission of the UFC Performance Institute has always been to position itself at the forefront of innovation and expertise across the combat sport landscape and to provide our athletes and coaches with the best opportunity to succeed by offering individualized and custom approaches to support performance. Philosophically, we acknowledge not only the individual nature of MMA as a sport, but importantly, the individual nature of human physiology, skill acquisition, mental fortitude and a variety of other factors that go in to making the complete athlete, martial artists, and fighter (i.e., the MMA triad). To do this we are committed to a multi-step process of "reverse engineering" performance that allows us to accurately and intentionally target the specific factors that determine success. This includes:

i) Having an accurate understanding of what truly happens during MMA competition and what it takes to win (i.e., fight trends and characteristics)
ii) Comprehensively evaluating all aspects of technical, physical and physiological performance standards
iii) Executing a "gap analysis" to determine how fighters compare against population norms for their weight class
iv) Developing bespoke programming strategies (technical and physical) that are designed to target the specific needs of each individual
v) Objectively monitoring and evaluating the success of given interventions
vi) Addressing any specific issues that are personal to a given fighter (i.e., chronic injury factors, metabolic disruption, underperformance factors)
vii) Working on an individual level to create competitive advantages that can elevate the likelihood of success.

This methodological process provides the most comprehensive and complete approach to optimizing the off-camp, fight-camp and fight-week phases, as well as any special considerations that need to be made.

We hope that everyone who reads this information finds true value in it and feels that it supports understanding of contemporary MMA and the factors that must be considered in order to maximize potential for success. The UFC Performance Institute team is humbled by the opportunity to help and support the world's greatest athletes compete in the sport they love. This journal represents a small part of "giving back" to the combat community by sharing our insights and experiences and working to consistently accelerate the evolution of the sport of MMA.



PART I

STRATEGY & GOALS



SECTION 1: COMPETITION ANALYSIS

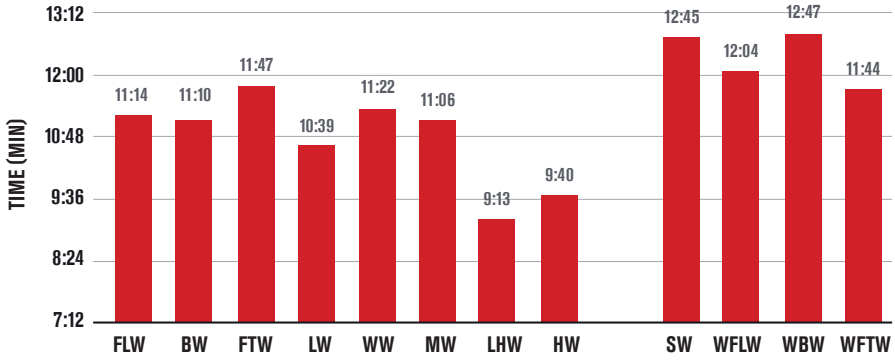
By Forrest Griffin, Roman Fomin, Richy Walsh and Dean Amasinger

The sport of MMA is constantly evolving, with rapid changes in styles and techniques clearly apparent since UFC first professionalized the sport in 1993. The constant evolution of MMA makes adjusting the UFC to stylistic trends and techniques difficult to forecast, but it is necessary that fighters and coaches continue to understand the characteristics of competition in order to prepare effectively. Previously, the UFC Performance Institute (UFC PI) has reported competition trends across an extended 15-year period, from 2002-2017 (see A Cross Sectional Performance Analysis and Projection of the UFC Athlete, Vol. 1, 2018). However, to provide a more current overview of modern-day UFC fight characteristics, the data presented throughout this section is from 1,443 UFC bouts, between 2017 and 2019, with all men's and women's weight classes included, as well as fights scheduled for both 15 and 25 minutes (data from 2020 is not included here due to the impact of COVID-19 on Octagon size, match making, and fight characteristics).

FIGHT DURATION AND POSITION DISTRIBUTION

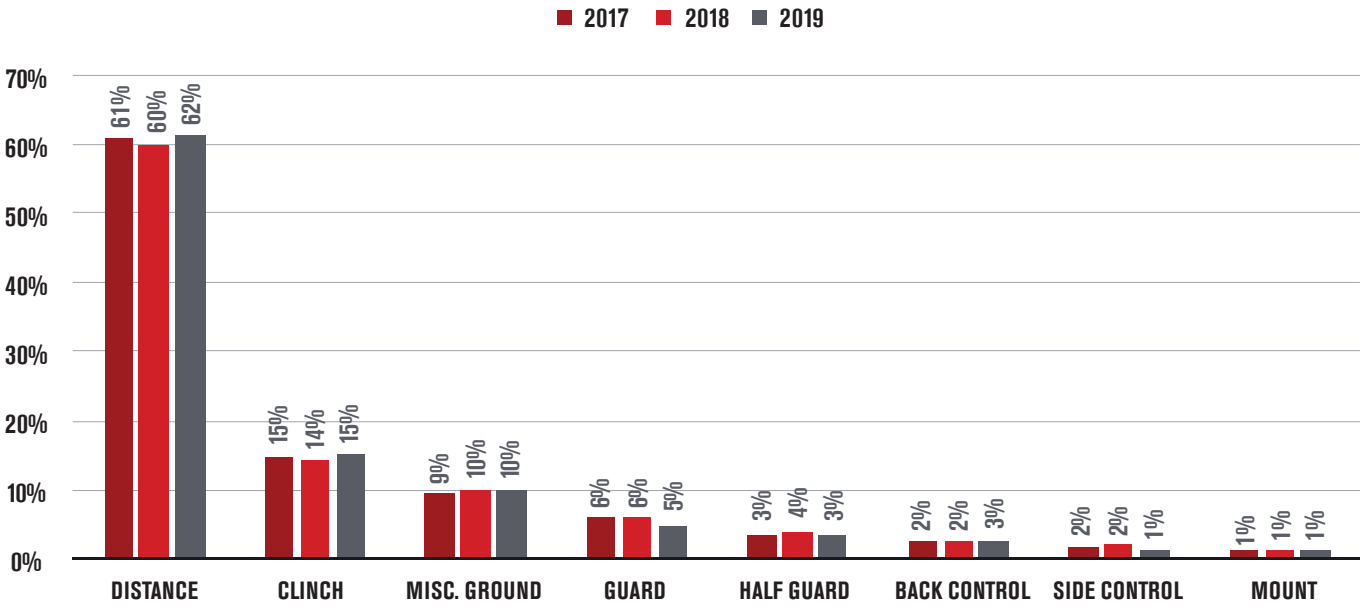
The average fight duration across all weight classes continues to rise as more fights go to decision (Figure 1.1). This can potentially be attributed to the same factors listed in Volume 1 (e.g., the influence of better defensive techniques, fighters being better physically prepared and greater parody in matchmaking). While the number of 25-minute bouts has continued to grow, the ratio of 25-minute bouts to 15-minute bouts has remained relatively stable so this does not account for the gradual increase in fight time. From this data, it is apparent that larger weight classes tend to have shorter fight durations. However, they also have lower activity levels, as shown in later sections. Typically, women's UFC bouts last longer than those of their male counterparts.

FIGURE 1.1
AVERAGE FIGHT DURATION BY WEIGHT CLASS (2017-2019)



While having an understanding of fight duration does present some rudimentary insight into fight characteristics that can be potentially used to inform tactics, strategy, and physical conditioning needs, this metric is limited at best. To better understand the characteristics of modern-day UFC fights further, the positional distribution of where fights are taking place provides more value (see Figure 1.2).

FIGURE 1.2
FIGHT TIME BY POSITION (%)





The largest percentage of UFC fights (61%, 60% and 62% respectively for 2017, 2018 and 2019) take place at distance (i.e., when fighters are standing at range and not touching). From this information, we can highlight the importance that stand-up striking plays in UFC. Furthermore, this insight highlights the importance for fighters to develop the ability to setup takedowns or close the distance for a takedown, as a large percentage of the fight takes place on the feet at distance.

Elsewhere, UFC fights have seen a rise in the percentage of time spent in clinch positions, most of which occurs against the fence and emphasizes the importance of pummeling, head position, pushing off the fence and trading places with an opponent (i.e., a fighter moving from having his or her back on the fence to putting his or her opponent's back on the fence). Conversely, it also highlights the importance of being able to take opponents down against the fence, as a significant portion of the fight will likely take place in this position (approximately 15 percent).

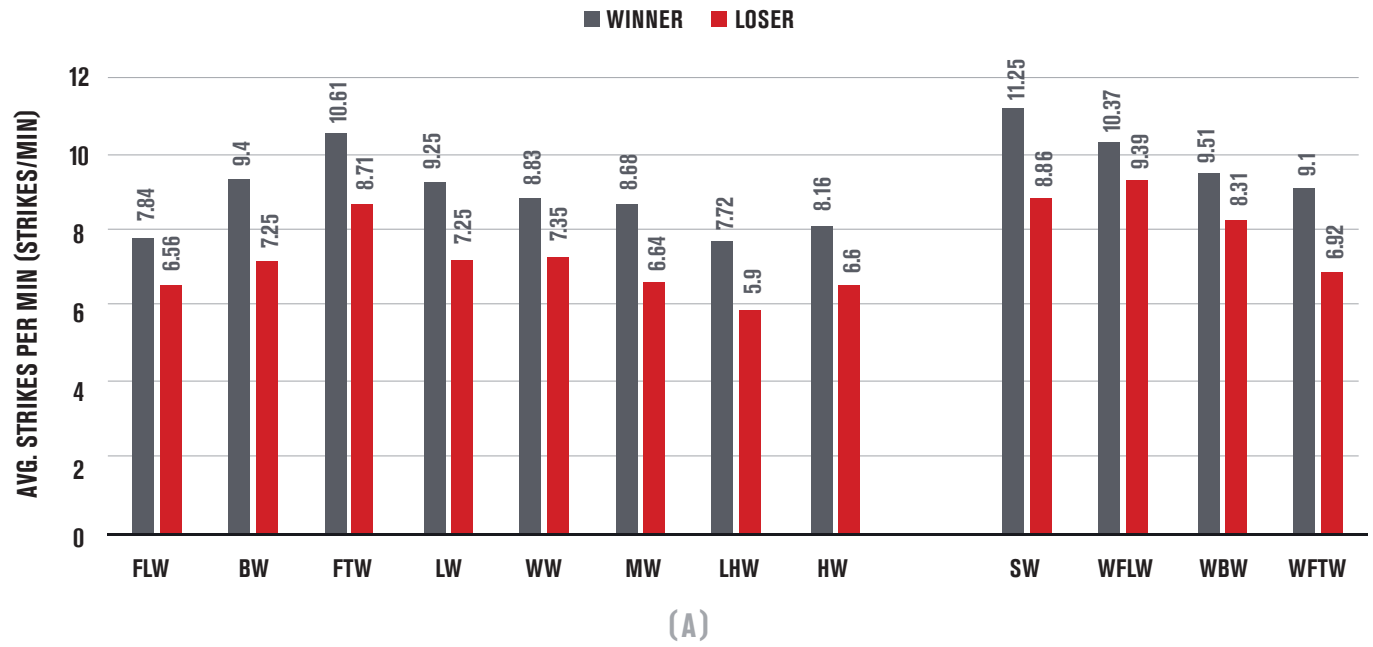
Miscellaneous ground positions are the third most common fight position and can refer to several grounded positions, including when a fighter is standing over a grounded opponent, when a fighter is sprawled over his or her opponent or when "scrambles" are occurring and a position is unsecured. These scrambles often occur as one fighter attempts to defend a takedown or escape from a grounded position. Effective scrambling is important due to the effort required to get up from underneath an opponent who has secured top position, the difficulty to defend against strikes from a grounded position, the relatively low chance of getting a submission from a bottom position and the weight of scoring a takedown and securing top control on judging criteria. The five remaining ground positions represent the distribution of the most common ground positions in UFC.

WORK RATES: FIGHT VOLUME AND INTENSITY

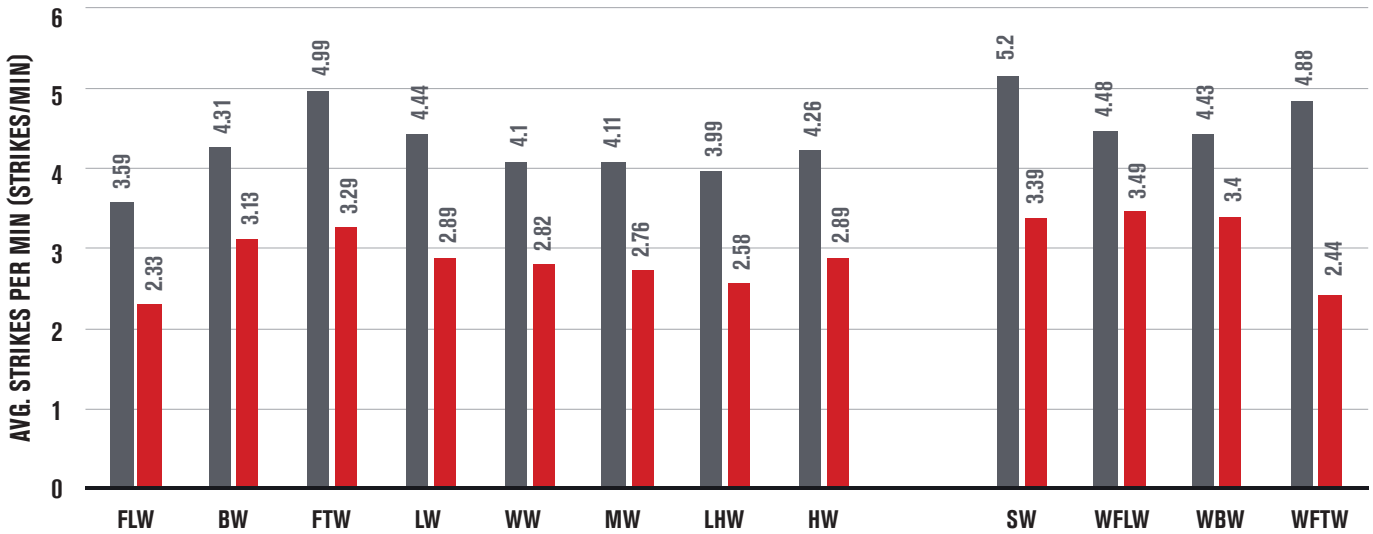
To present the work rate between winners and losers for each of the UFC weight classes, we have captured the respective volumes of striking attempts (Figure 1.3) and takedown attempts (Figure 1.4 and 1.5) and have presented them normalized by time. It is worth noting that there are other aspects of a fight where work rates could be worth considering that were unable to be reliably collected at the present time (e.g., the distance covered, speed of movement during a fight and blocked strikes vs strikes avoided—as it is reasonable to assume that there is a different energy expenditure between blocking a strike and avoiding a strike).

FIGURE 1.3

AVERAGE STRIKES ATTEMPTED (A) AND LANDED (B) BY WINNERS AND LOSERS PER WEIGHT CLASS (2017-2019)



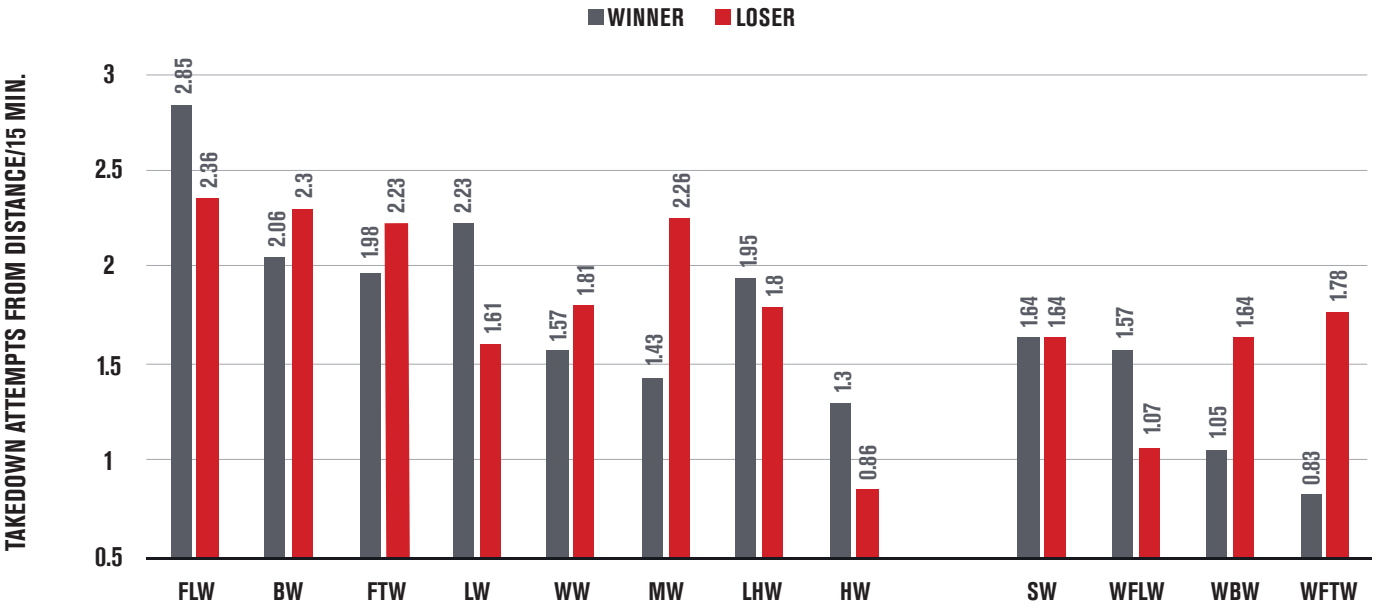
(A)



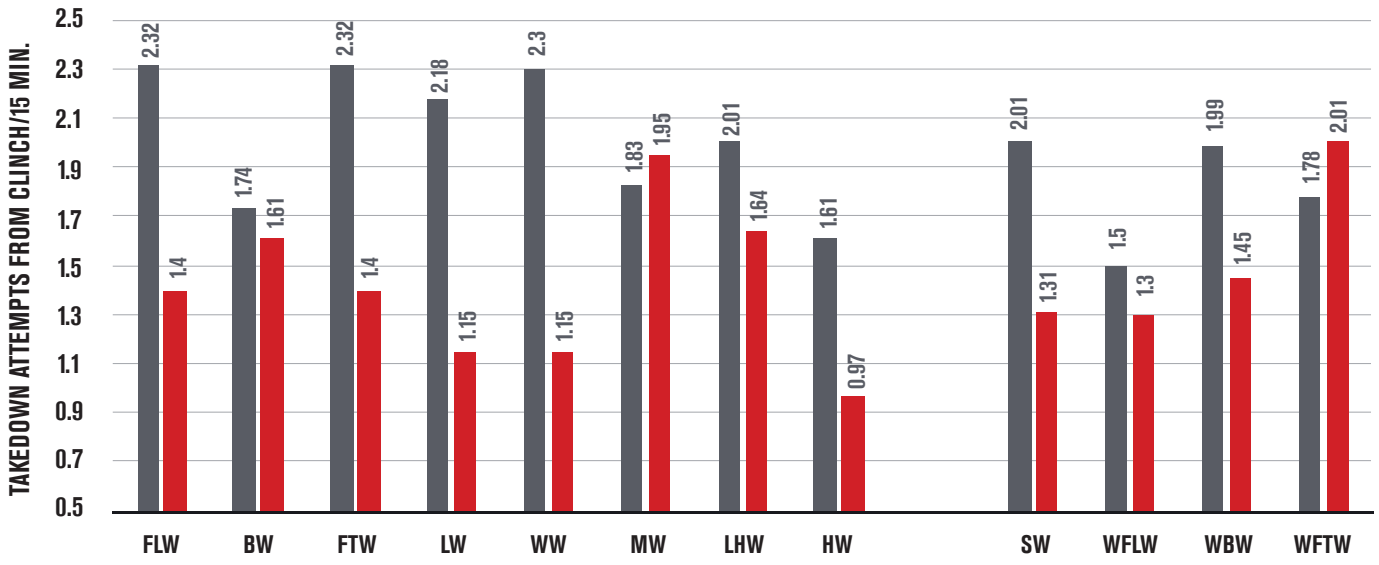
(B)

FIGURE 1.4

AVERAGE TAKEDOWN ATTEMPTS FROM DISTANCE (A), AND THE CLINCH (B)



(A)



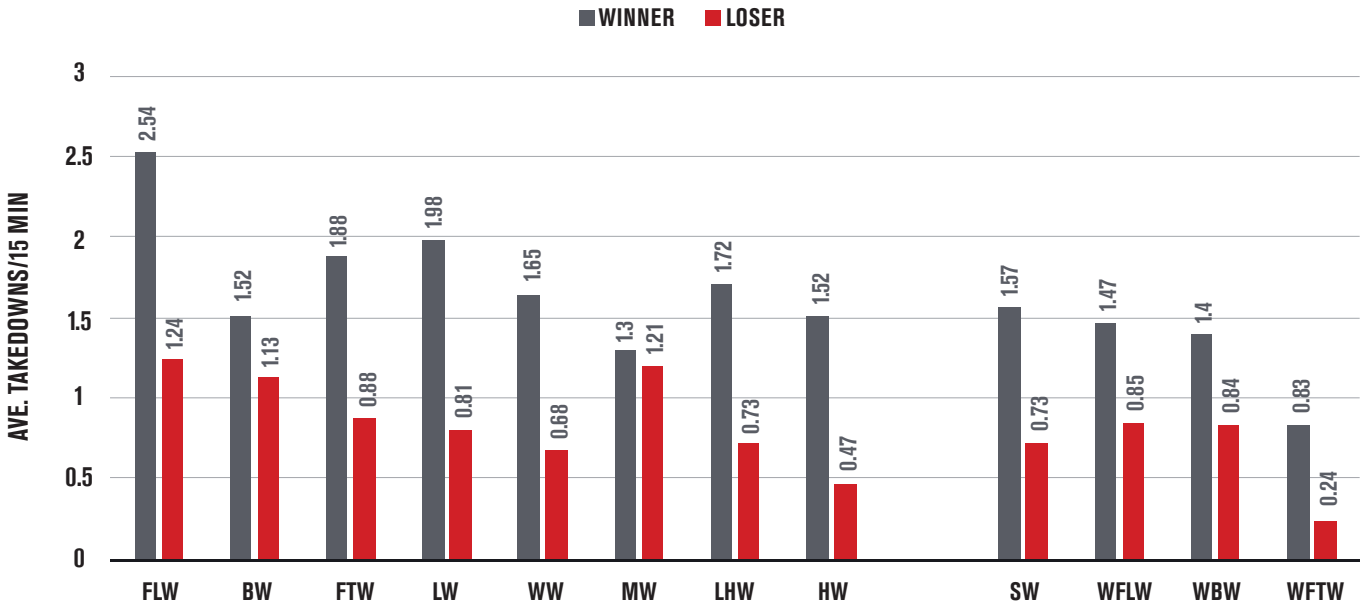
(B)

In all weight classes, winning fighters attempted and landed more strikes than their opponents. Two important concepts can be explained with this data. The first concept is that the more strikes a fighter lands, the more chance one of those strikes could KO or TKO his or her opponent. The more common, second concept is that landed strikes are one of the most significant scoring criteria for judging.

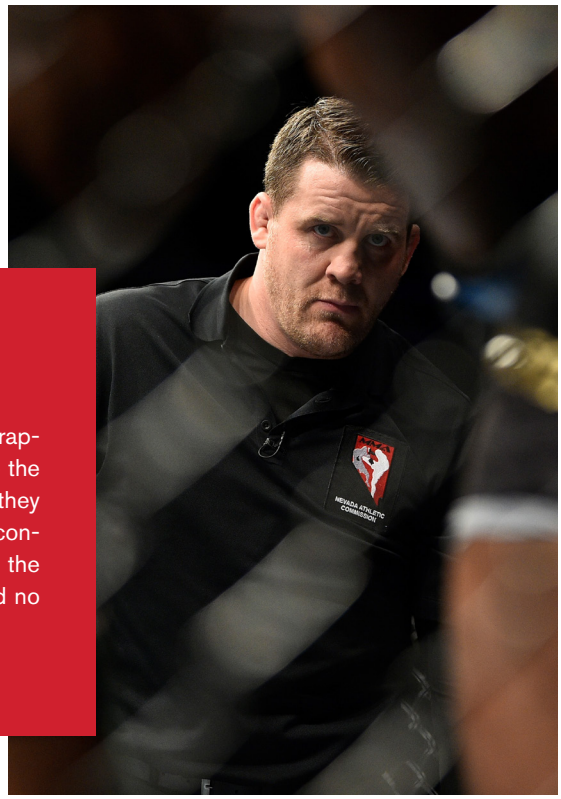
The factors that make up a proxy of fight intensity include strikes attempted vs strikes landed per minute, takedowns attempted vs takedowns completed per minute (broken into takedowns from distance and takedowns from the clinch) and submissions attempted vs submissions completed across weight classes.

FIGURE 1.5

AVERAGE TAKEDOWNS PER 15 MINUTES (2017-2019)



It should be noted that these are successful takedown attempts which have a large impact on winning the fight due to the influence of effective grappling control on judging criteria. An important caveat would be that in the judging criteria, a "successful takedown is not merely a change of position but the consequent establishment of an attack from the use of a takedown." (Unified Rules of Mixed Martial Arts, ABC MMA Rules Committee, 2016)



JUDGING CRITERIA:

The first scoring criteria for judges is effective striking or grappling. It is worth noting that judges are instructed not to use the "Plan B" criteria, which is effective aggressiveness unless they can find no advantage in the striking or grappling realm. In continuance with this theme, judges are instructed not to use the "Plan C" criteria of fighting area control unless they can find no advantage in the first two criteria.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"THE FACT THAT WOMEN'S STRAWWEIGHTS AND FLYWEIGHTS HAVE THE HIGHEST PERCENTAGE OF DECISION WINS IS RELATED TO THEIR PROLONGED FIGHT DURATIONS."

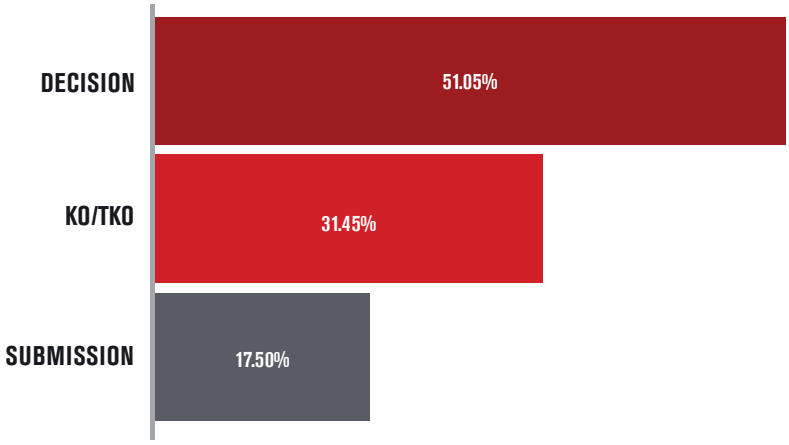
WIN METHODS

Win methods pooled across weight classes are presented in Figure 1.6 A and B. Decisions continue to make up approximately 50% of win methods, with KO/TKO around 30% and submissions approximately 20%.

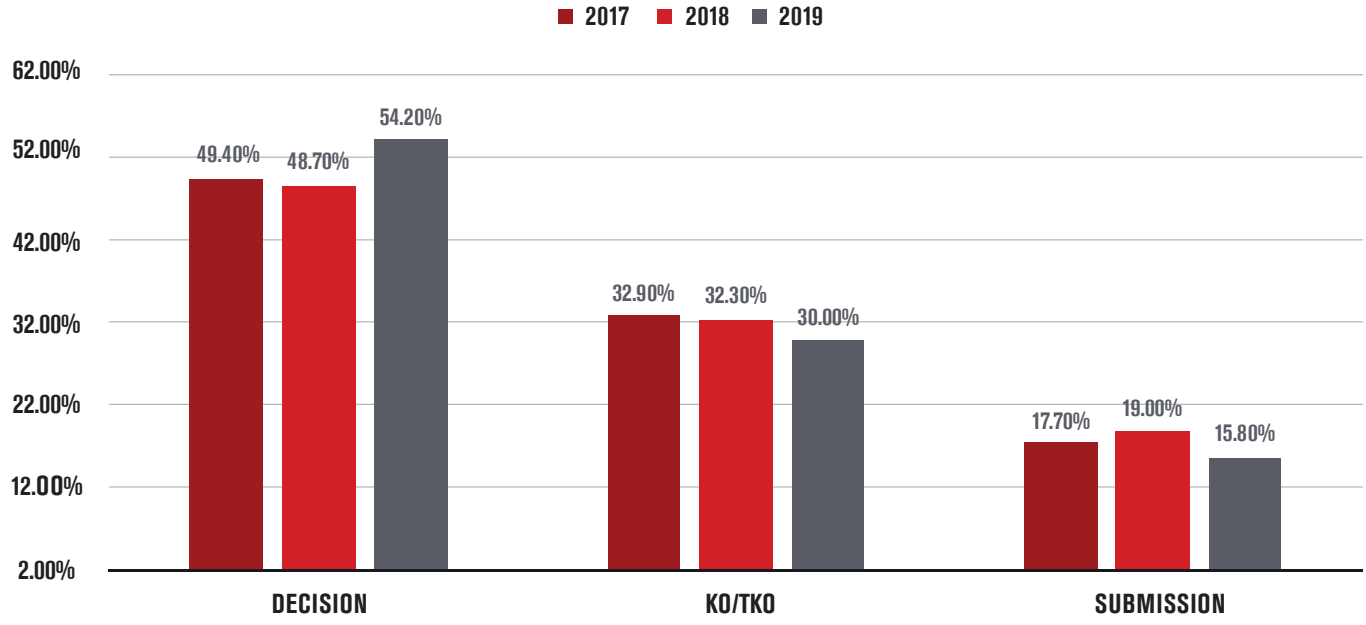
Insight into the different physical and technical attributes used in different weight classes can be gleaned from Figure 1.7. Heavyweight and light heavyweight are the only weight classes in which the majority of fights do not go to decision and are ended by KO or TKO. The rate of KO/TKO is higher than the rate of submission in all weight classes, with the exception of women's strawweight and flyweight. The fact that women's strawweights and flyweights have the highest percentage of decision wins is related to their prolonged fight durations, as previously shown in Figure 1.1.

FIGURE 1.6

AVERAGE WIN METHOD (A), AND WIN METHODBY YEAR 2017-2019 (B)



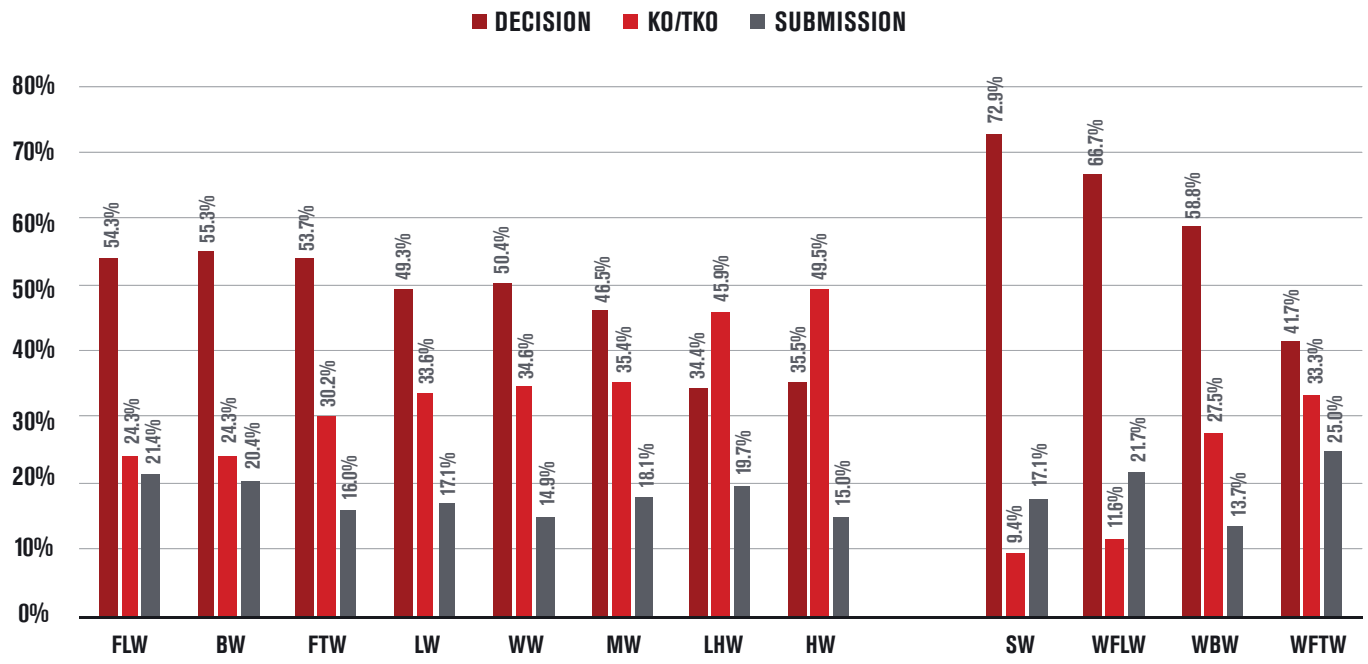
(A)



(B)

FIGURE 1.7

WIN METHODS BY WEIGHT CLASS







SUCCESS RATE

While the arsenal of techniques employed in UFC fights has continually expanded over time, the most commonly targeted areas have remained relatively unchanged in recent years (Figure 1.8). As expected, the head is by far the most commonly targeted area. One can surmise that this is due in part to KOs and TKOs to the head being the most common non-decision method of win (see Figure 1.6) in all but two weight classes (SW, WFLW). There are a host to other reasons why the head is a good target area. For instance, the facial area is one of the easiest regions in the body to cut, and a cut in a fight may disrupt a fighter (e.g., blood from the cut impairing a fighter's vision) and may influence judging. Coaches and fighters can interpret this data on strikes to the body and leg in a variety of different ways. For example, a coach or fighter might think most opponents will be ready to defend their heads, and this may allow more opportunity to attack the body and legs. Related to this is the common MMA tactic of attacking the body or legs in an attempt to setup strikes to the head.

For a greater understanding of the influence of striking success rate on fight outcomes, Figure 1.9 shows the percentage success rate for winners and losers in each weight class. Winning fighters not only attempted more strikes, but they also connected at a higher percentage resulting in higher accuracy scores.

With respect to grappling, winning fighters attempted more submissions than their opponents and, of course, also completed more submissions (Figure 1.10).



FIGURE 1.8

STRIKING DISTRIBUTION BY BODY PART (%)

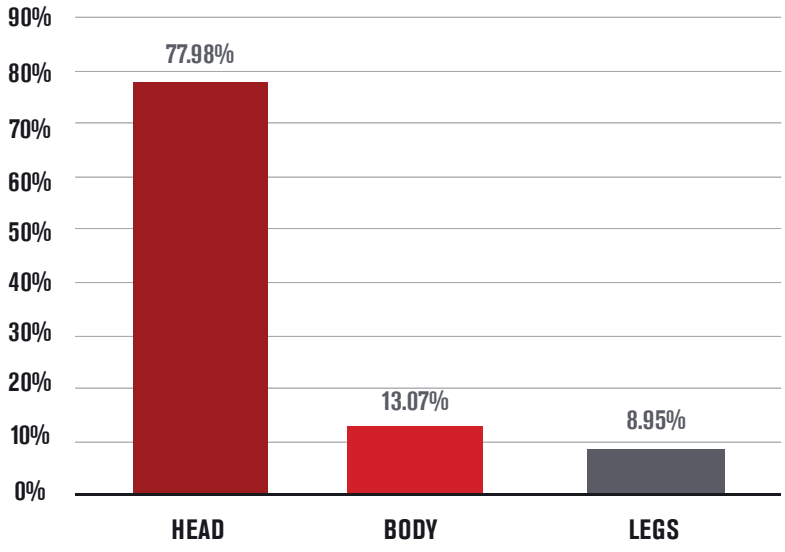


FIGURE 1.9

STRIKING SUCCESS RATE

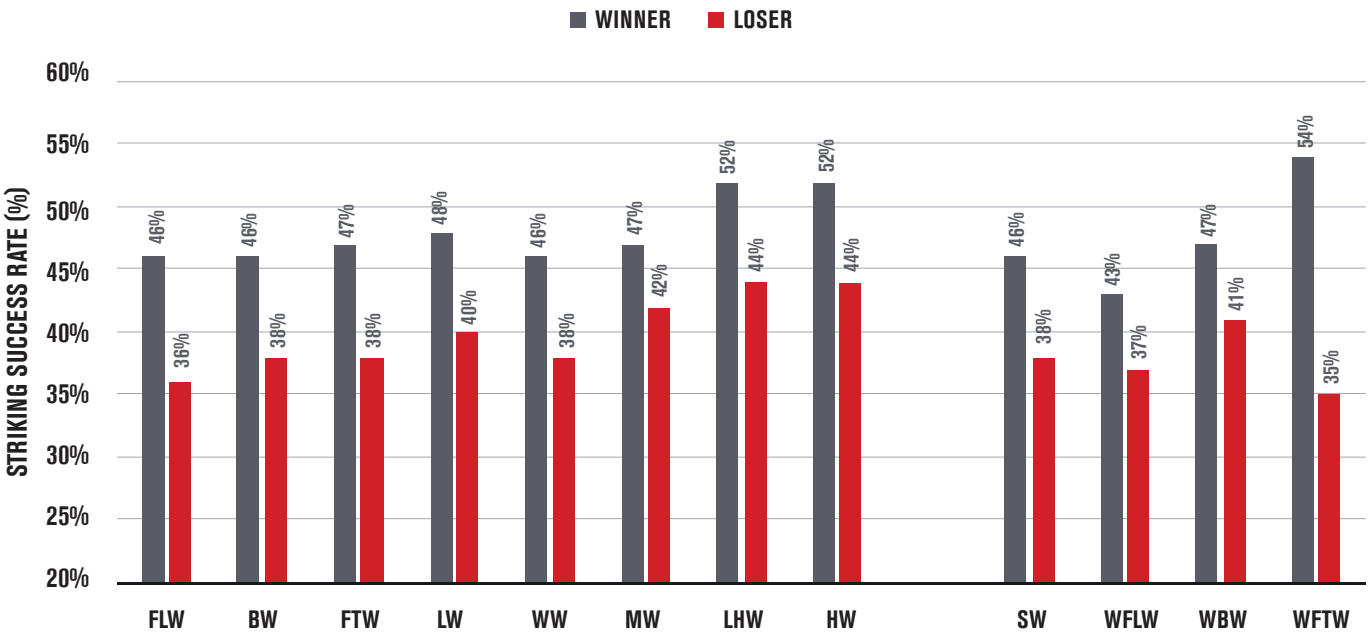
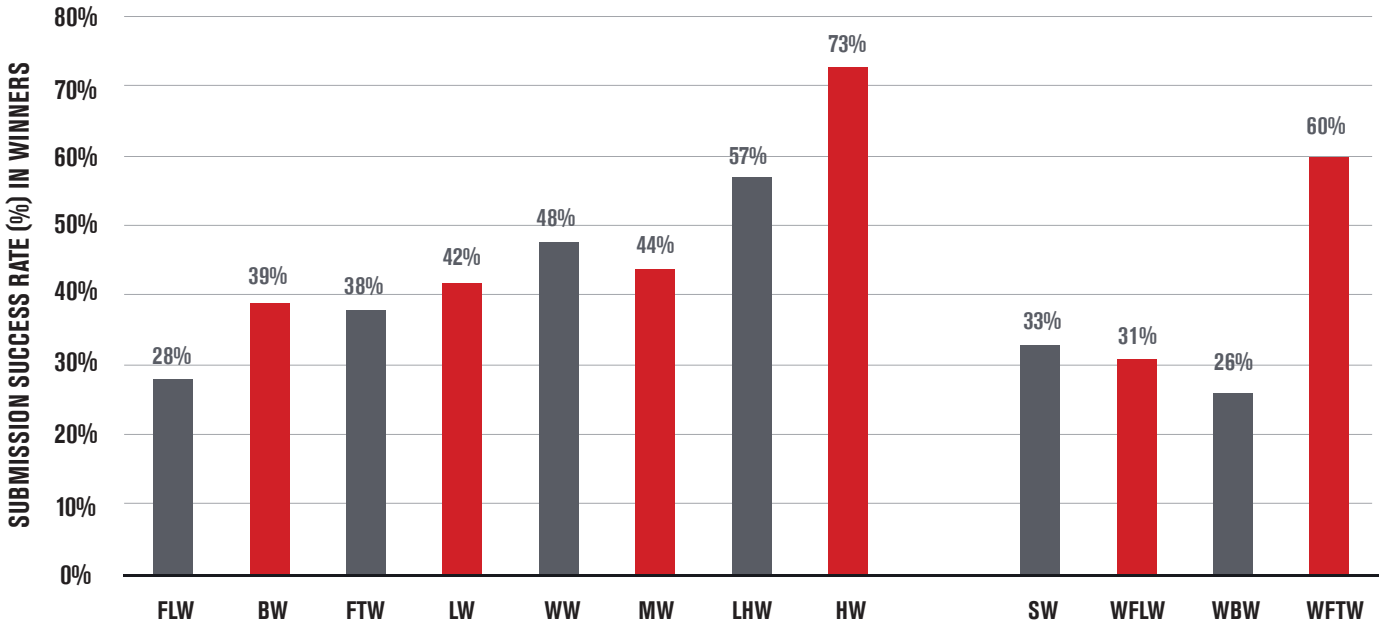


FIGURE 1.10

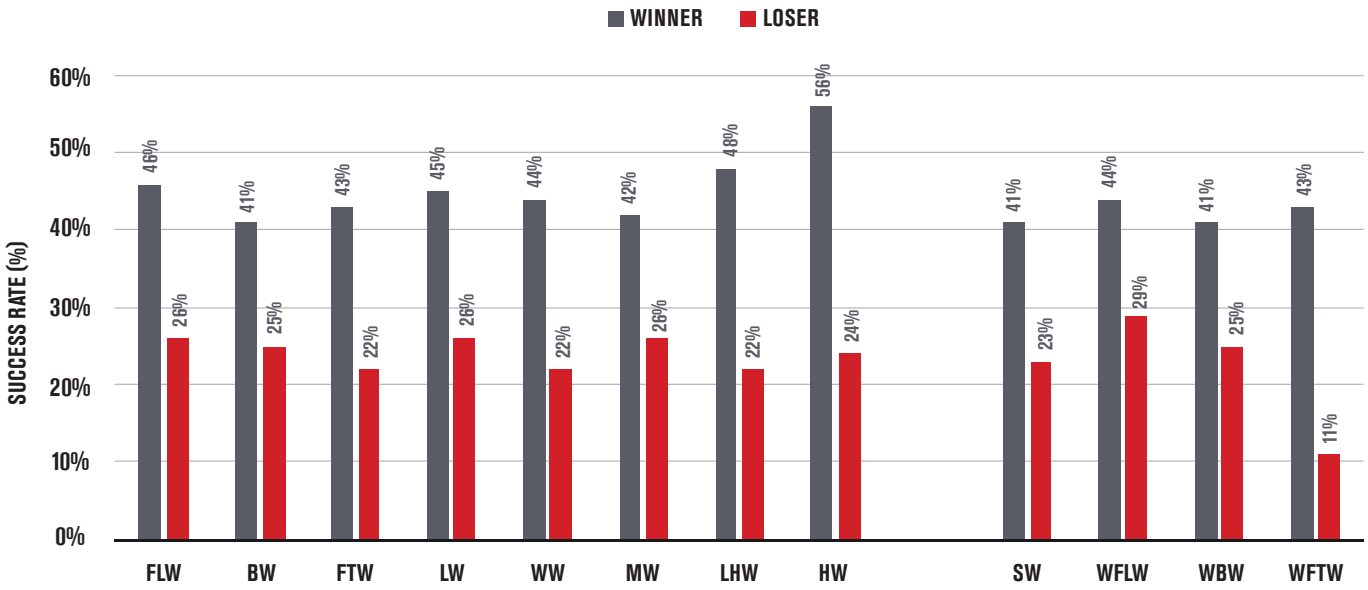
SUBMISSION SUCCESS RATE (2017-2019)



The combined success rate (Figure 1.11) is defined as the combined total success rate for striking, wrestling takedowns and submissions. The range of success varies from 56% for heavyweight winners to 41% for both women's strawweights and bantamweights. The key takeaway here is that, not only do winning fighters attempt more offensive techniques, but they also have between 16-32% higher percentage success rate than losing fighters.



FIGURE 1.11
COMBINED SUCCESS RATE (2017-2019)



FINISHES BY WEIGHT CLASS

In order to gain a more comprehensive understanding of the most effective tactics used in each of the respective weight classes, the Top 6 finish methods are presented below. Having an understanding of these techniques can help athletes better prepare defensively and tactically for fights.

125lbs

FLYWEIGHT (FLW)	
PUNCHES	40.6%
RNC	34.4%
KICKS	6.3%
ARMBAR	6.3%
TRIANGLE	3.1%
GUILLOTINE	3.1%

205lbs

LIGHT HEAVYWEIGHT (LHW)	
PUNCHES	50%
RNC	11.2%
ELBOWS	7.5%
KNEES	6.3%
TRIANGLE	3.7%
GUILLOTINE	3.7%

135lbs

BANTAMWEIGHT (BW)	
PUNCHES	33.8%
RNC	11.8%
GUILLOTINE	8.8%
ELBOWS	7.4%
KICKS	7.4%
OTHER CHOKES	5.9%

265lbs

HEAVYWEIGHT (HW)	
PUNCHES	57.9%
RNC	8.8%
KNEES	8.7%
ELBOWS	7.2%
ARM TRIANGLE	4.4%
ARM BAR	2.9%

145lbs

FEATHERWEIGHT (FTW)	
PUNCHES	49.3%
RNC	16%
ELBOWS	5.3%
KICKS	5.3%
GUILLOTINE	5.3%
OTHER CHOKES	5.3%

115lbs

WOMEN'S STRAWWEIGHT (SW)	
RNC	53.8%
PUNCHES	23%
ARM BAR	7.6%
KICKS	3.8%
GUILLOTINE	3.8%
DOCTOR STOPPAGE	3.8%

155lbs

LIGHTWEIGHT (LW)	
PUNCHES	43.6%
RNC	12.7%
KNEES	7.3%
KICKS	6.4%
OTHER CHOKE	6.4%
GUILLOTINE	5.5%

125lbs

WOMEN'S FLYWEIGHT (WFW)	
ARM BAR	39.1%
RNC	26.1%
PUNCHES	17.4%
ELBOWS	8.7%
KNEES	4.3%
KICKS	4.3%

170lbs

WELTERWEIGHT (WW)	
PUNCHES	46.9%
RNC	13.2%
KNEES	8.8%
KICKS	7.9%
GUILLOTINE	5.3%
ELBOWS	3.5%

135lbs

WOMEN'S BANTAMWEIGHT (WBW)	
PUNCHES	47.6%
ARM BAR	14.3%
ELBOW	9.5%
ARM TRIANGLE	9.5%
KICKS	9.5%
RNC	4.8%

185lbs

MIDDLE WEIGHT (MW)	
PUNCHES	48.1%
RNC	15.5%
KICKS	12.9%
GUILLOTINE	6.5%
ARM TRIANGLE	5.2%
ELBOWS	2.6%

145lbs

WOMEN'S FEATHERWEIGHT (WFTW)	
PUNCHES	48.1%
RNC	15.5%
KICK	12.9%
GUILLOTINE	6.5%
ARM TRIANGLE	5.2%
ELBOWS	2.6%

FIGURE 1.12
SUBMISSIONS BY POSITION

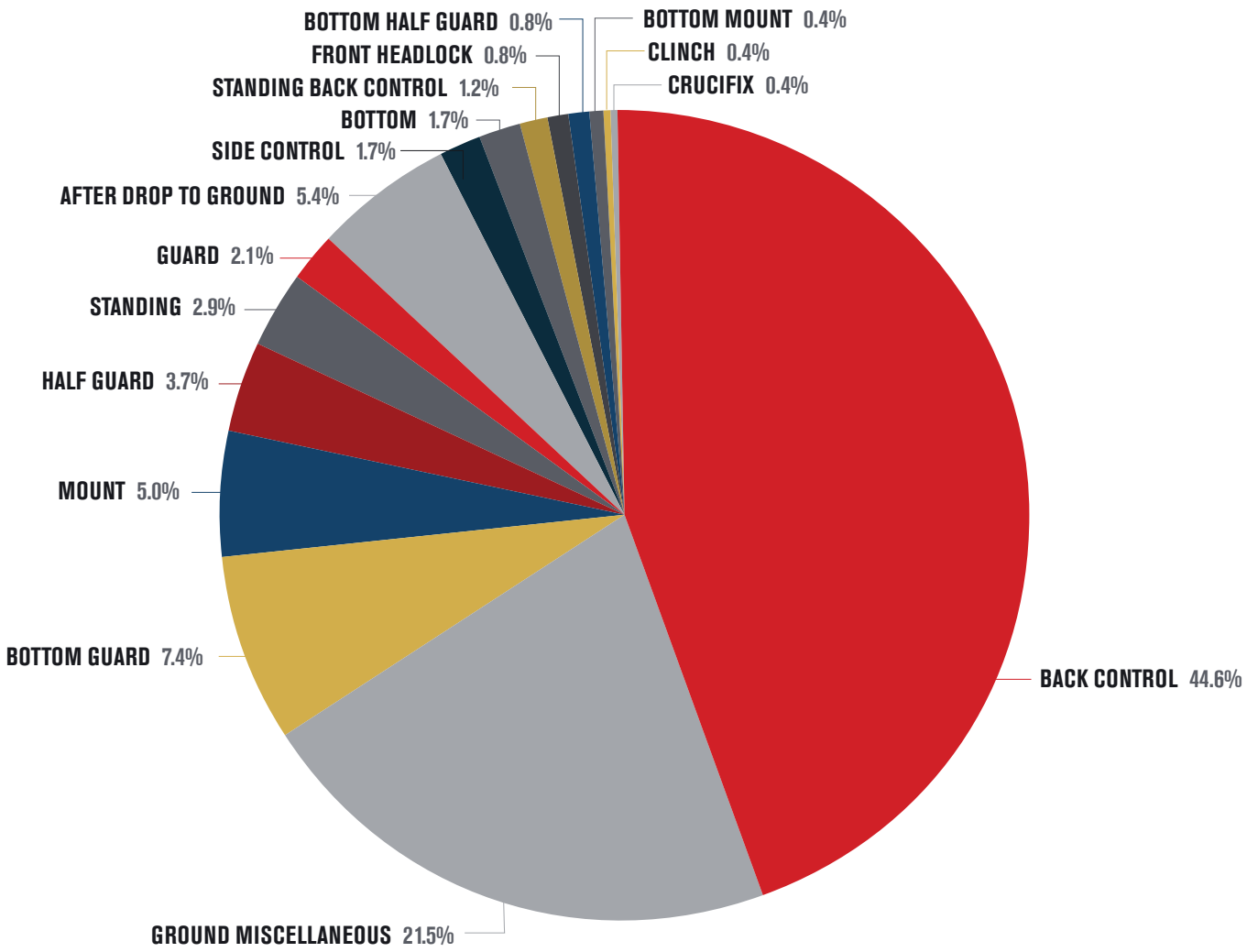
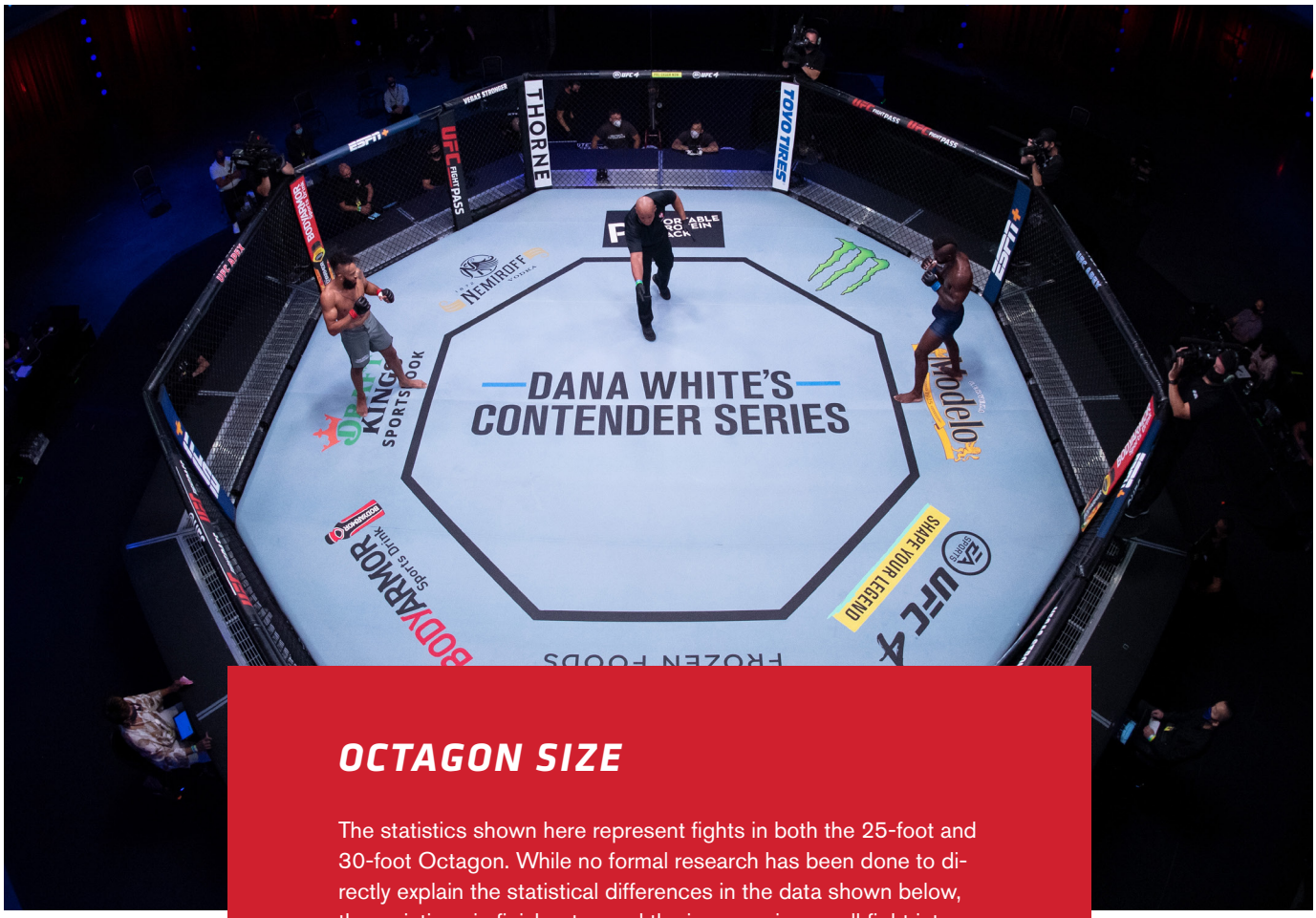


Figure 1.12 shows all the positions that submissions have occurred from between 2017-2019. Back control is the most common position to be submitted from. This is logical considering the rear-naked choke (RNC) is the most common submission in UFC. It is worth noting that three standing RNCs have occurred in the past three years. These are accounted for in the submissions from standing category. The positions of other common submissions can also be identified, including after dropped to ground submissions and standing submissions, which are both most often the guillotine, which coincides with the fact that the guillotine is the second most common submission when including all weight classes. Ground miscellaneous refers to a host of submissions that occur in an undefined ground positions, most of which can be attributed to chokes, and more specifically the D'arce choke or other variations of head and arm chokes.



OCTAGON SIZE

The statistics shown here represent fights in both the 25-foot and 30-foot Octagon. While no formal research has been done to directly explain the statistical differences in the data shown below, the variations in finish rates and the increase in overall fight intensity may be a result of the smaller area which promotes fighters to engage more frequently. This data suggests that it is reasonable to conclude that fighters should prepare to fight at a higher pace and volume when scheduled for fight in the 25-foot Octagon.

30

30-FOOT OCTAGON

No. of fights - 1,398

KO/TKO – 32%

Submission – 17%

Decision – 51%

Sig. strikes attempted - 8.56/min

Sig. strikes landed 3.73/min

25

25-FOOT OCTAGON

No. of fights – 174

KO/TKO – 37%

Submission – 25%

Decision – 39%

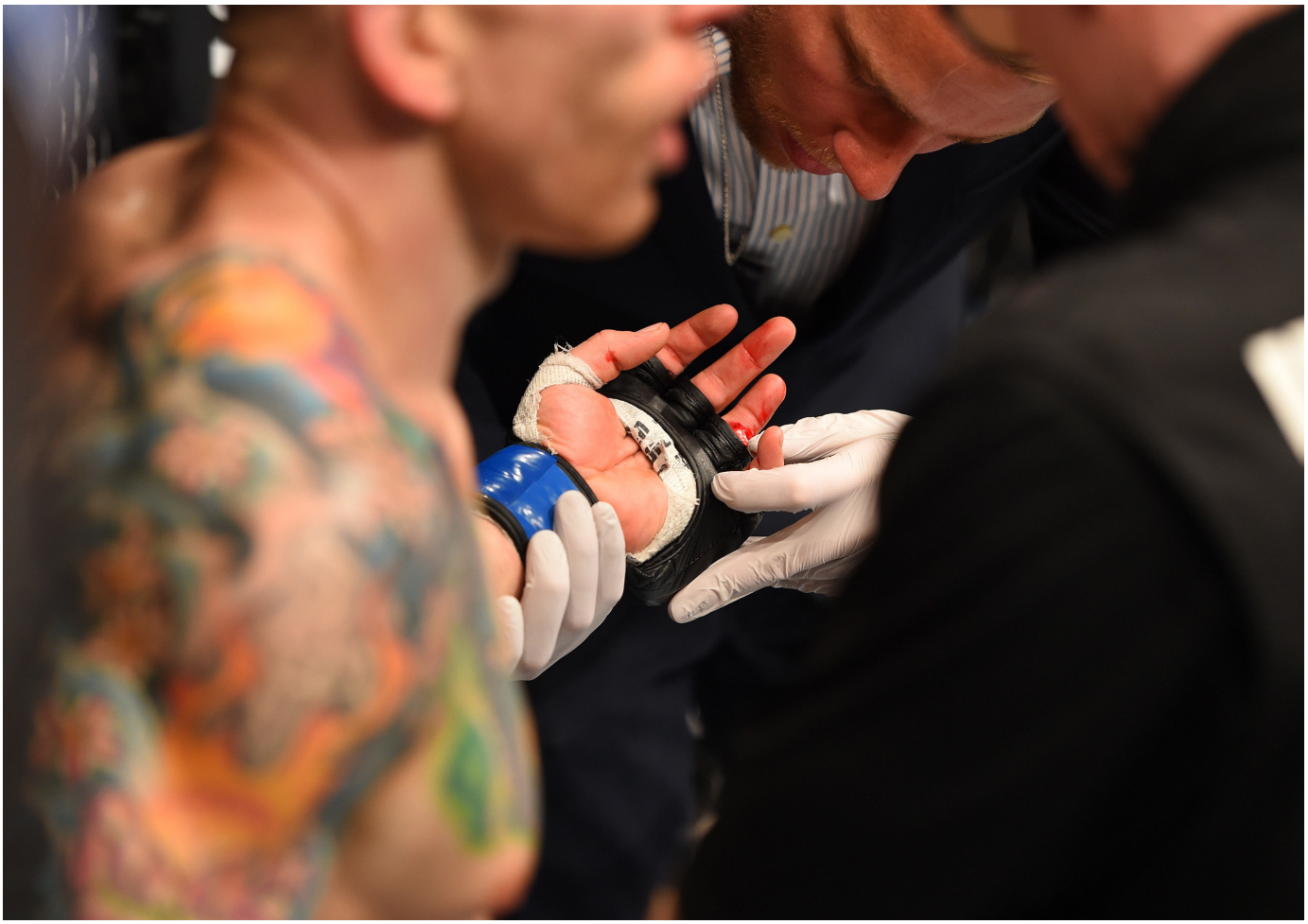
Sig. strikes attempted – 9.09/min

Sig. strikes landed 4.57/min


UFC



PART 1
SECTION 2



SECTION 2: INJURY CHARACTERISTICS

By Heather Linden

In the sport of MMA injuries are inevitable. Consequently, it is essential that as much insight as possible is gained about the way athletes are injured to develop better injury-prevention programs, reduce overall injury rates and improve recovery from injury. To do this, there needs to be a comprehensive understanding of injury characteristics so medical practitioners can be better prepared for the most pertinent injuries and their rehabilitation. This comprehensive understanding of injuries in UFC requires a data set large enough to look deeper into injury trends, mechanisms of injuries and time lost due to injury. In this section, the data presented includes 1,344 different injuries recorded in UFC fighters between 2017 and 2020.

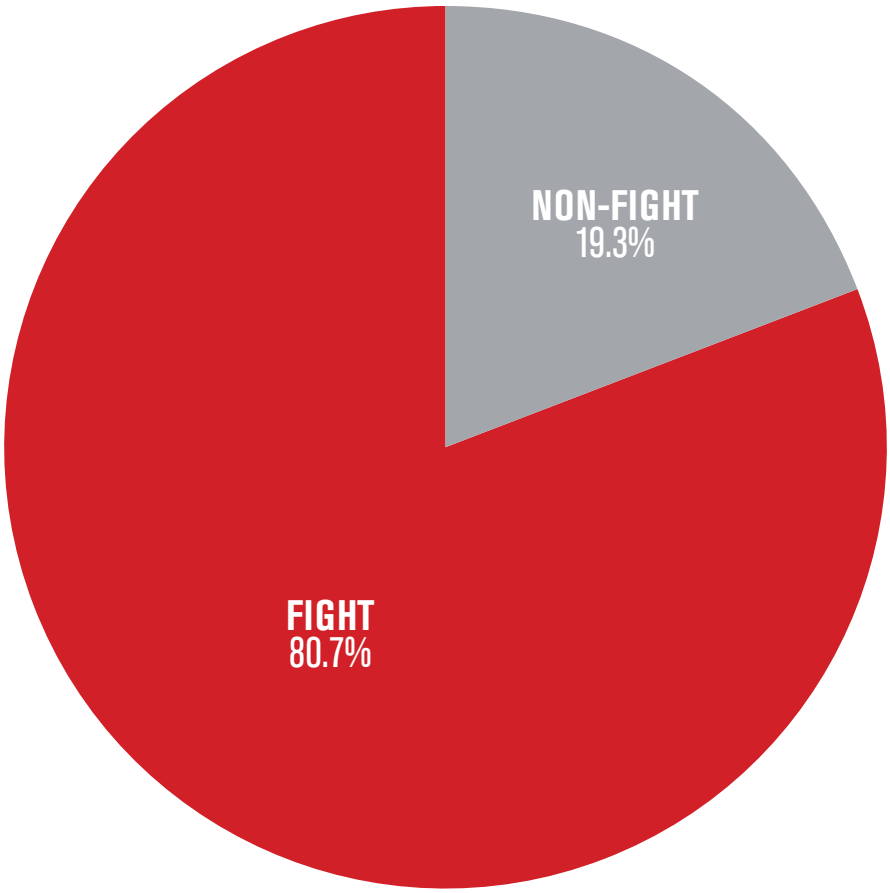


FIGURE 2.1
FIGHT AND NON-FIGHT INJURY RATES (2017-2020)

INJURY RATES

Musculoskeletal injuries usually occur when stress applied to bones, muscles, tendons, joints, ligaments and cartilage exceeds the capacity of normal tissue function. An initial review of injury characteristic data allows us to understand if injuries primarily occur due to trauma sustained in a competitive fight or more from overuse or chronic-type injuries as a consequence of training. Figure 2.1 shows fight and non-fight injury rates between 2017 and 2020. From this data, the majority of injuries in UFC are clearly sustained during the fight itself. It must be noted, however, that the number of non-fight injuries may be under-represented with athletes not always choosing to report all training injuries.

INJURY DISTRIBUTION

The data presented in Table 2.1 shows the total counts for injury distribution by body part for fight (A) and non-fight (B) injuries. In support of this data, Figure 2.2 shows the percent distribution for fight (A) and non-fight (B) injuries.

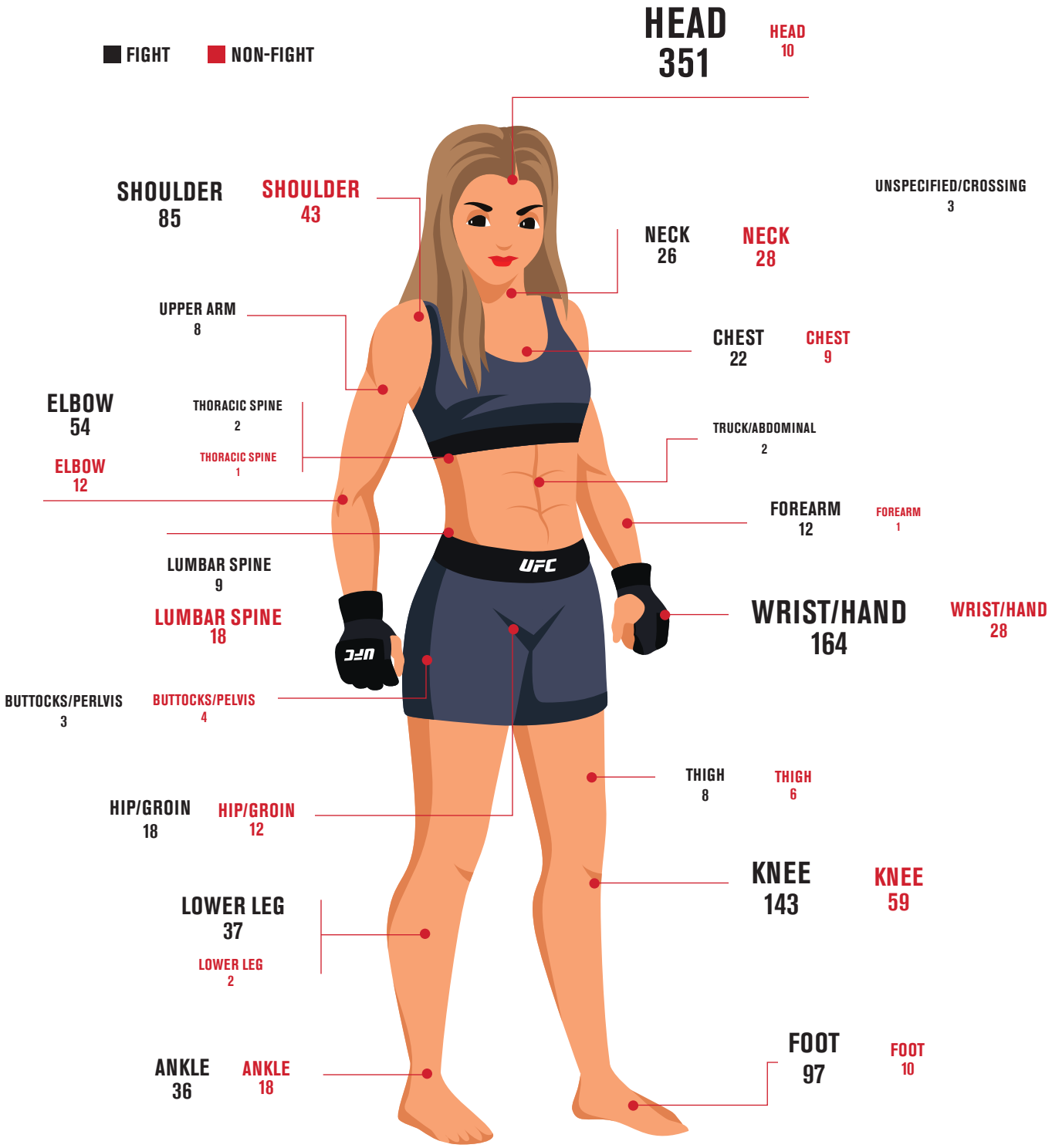


TABLE 2.1

FIGHT (A) AND NON-FIGHT (B) INJURY DISTRIBUTION BY BODY PART (TOTAL COUNT)

Body Area	Count of Pathology Classification
HEAD	351
WRIST/HAND	164
KNEE	143
FOOT	97
SHOULDER	85
ELBOW	54
LOWER LEG	37
ANKLE	36
NECK	26
CHEST	22
HIP/GROIN	18
FOREARM	12
LUMBAR SPINE	9
THIGH	8
UPPER ARM	8
BUTTOCK/PELVIS	3
UNSPECIFIED/CROSSING	3
THORACIC SPINE	2
TRUNK/ABDOMINAL	2

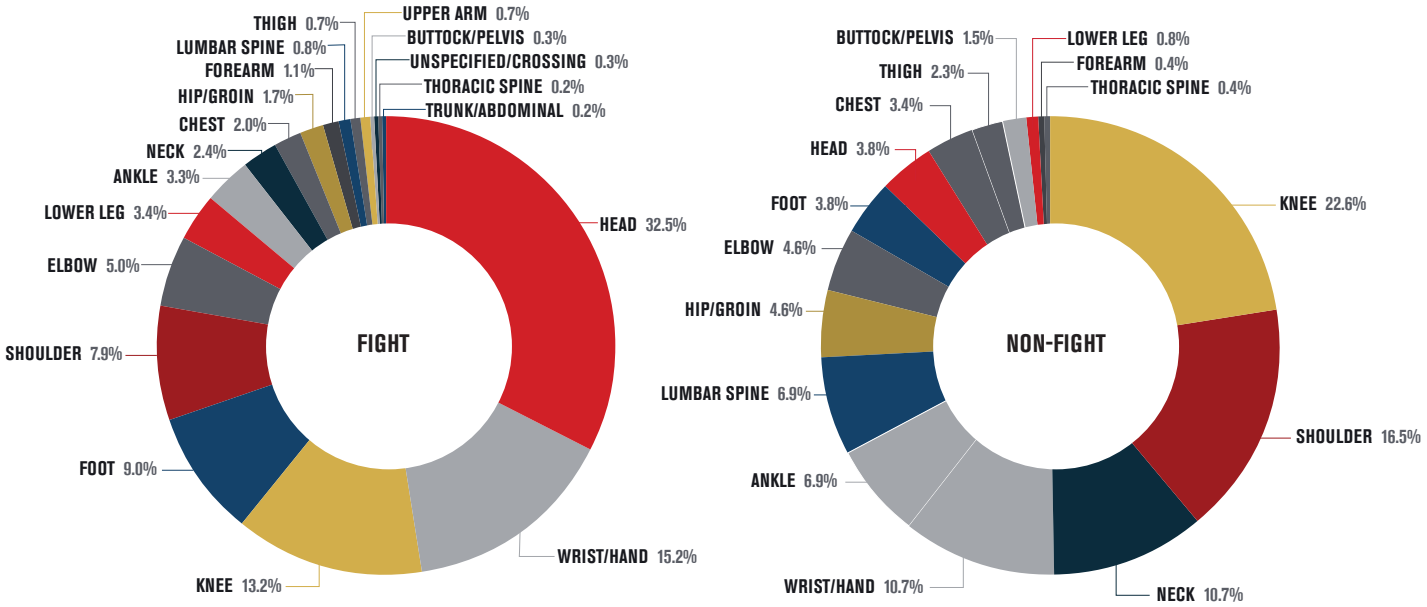
(A)

Body Area	Count of Pathology Classification
KNEE	59
SHOULDER	43
NECK	28
WRIST/HAND	28
ANKLE	18
LUMBAR SPINE	18
ELBOW	12
HIP/GROIN	12
FOOT	10
HEAD	10
CHEST	9
THIGH	6
BUTTOCK/PELVIS	4
LOWER LEG	2
FOREARM	1
THORACIC SPINE	1

(B)

FIGURE 2.2

FIGHT AND NON-FIGHT INJURY DISTRIBUTION BY BODY PART (PERCENTAGE)



MECHANISMS OF INJURY

An improved understanding of the specific mechanism of injury is possible by classifying the circumstance that cause injuries during fights and training (e.g. striking, grappling). This improved mechanism of injury understanding can better prepare support staff and coaches for the particular contraindications that an injured athlete may present. Figure 2.3 shows the combined mechanisms of injury for both men and women during both practice and UFC fights.

UFC fights present the highest level of intensity and obviously competition. The mechanisms of injury for both men and women in UFC fights between 2017 and 2020 are presented in Figure 2.4.

When data is broken down into non-fight/training injuries, we can see the highest mechanism of injury occurs during grappling (Figure 2.5). Grappling is used when two opponents are at close range, and the end result is to impose position on an opponent or to cause injury to the opponent through pressure on joints or airways. As grappling has the highest percentage of reported injury in training, we see this as an opportunity where support staff and coaches may be able to implement more prevention strategies in this training component. For example, communication between training partners may be prioritized and higher intensity grappling techniques completed earlier in a training session for fatigue reasons.

FIGURE 2.3

COMBINED MECHANISMS OF INJURY IN MEN AND WOMEN

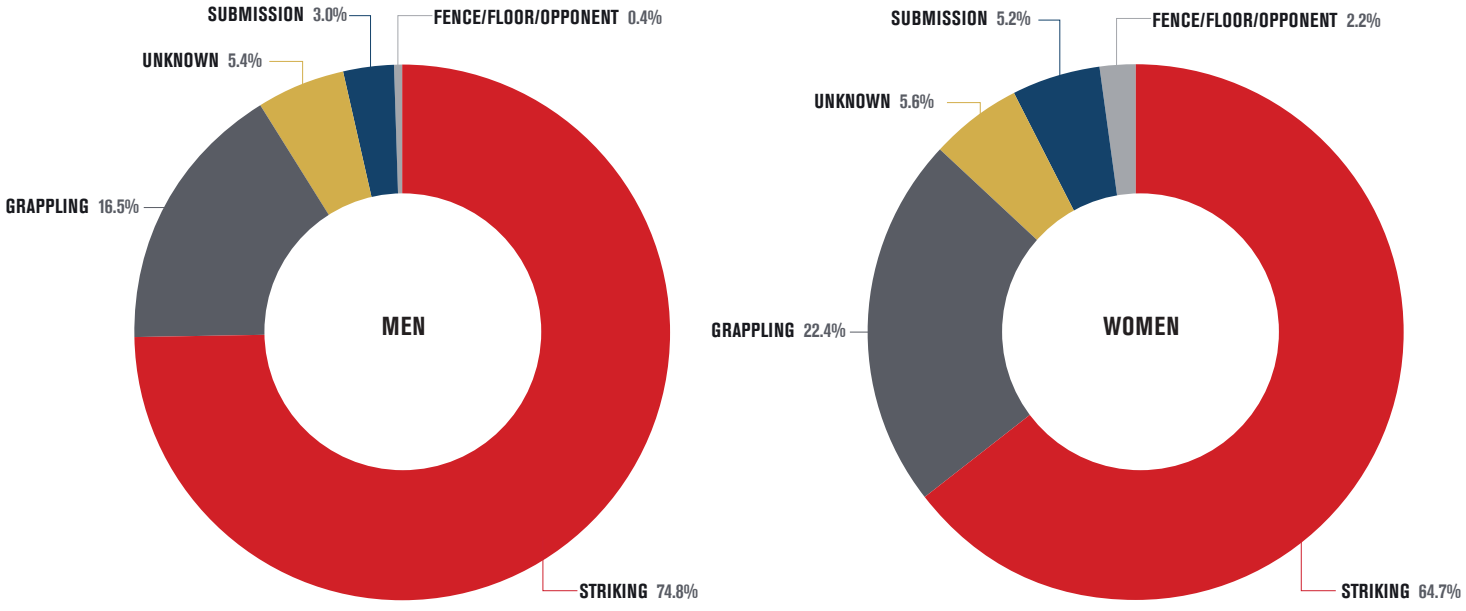


FIGURE 2.4

MECHANISMS OF INJURY DURING UFC FIGHTS IN MEN AND WOMEN

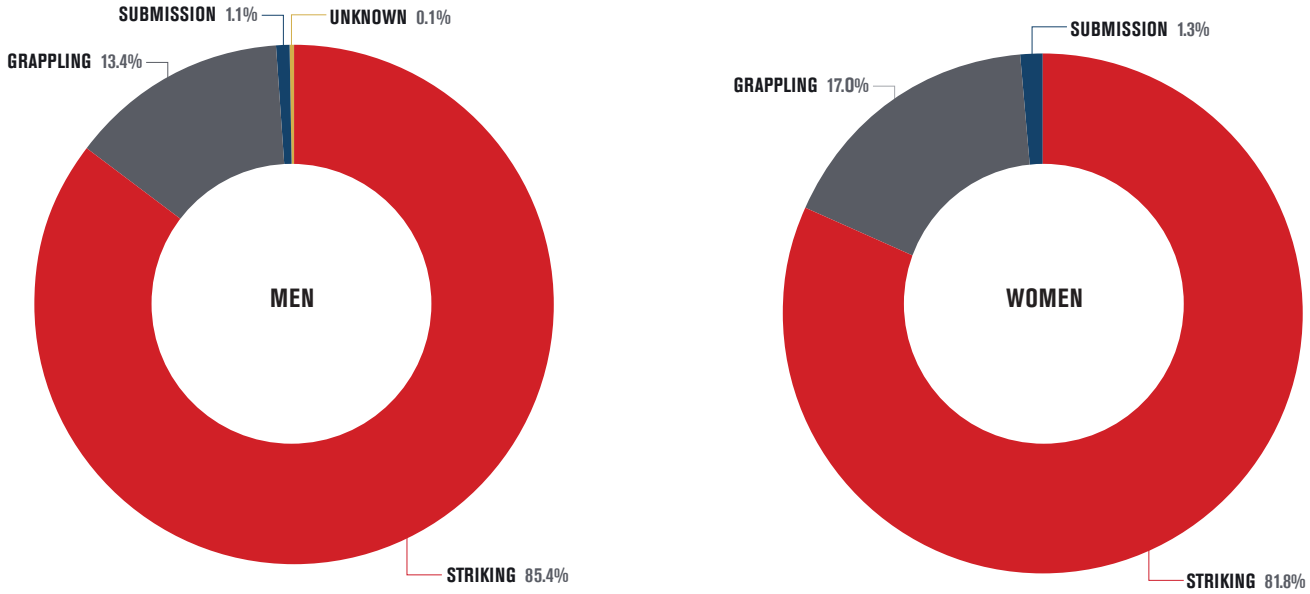
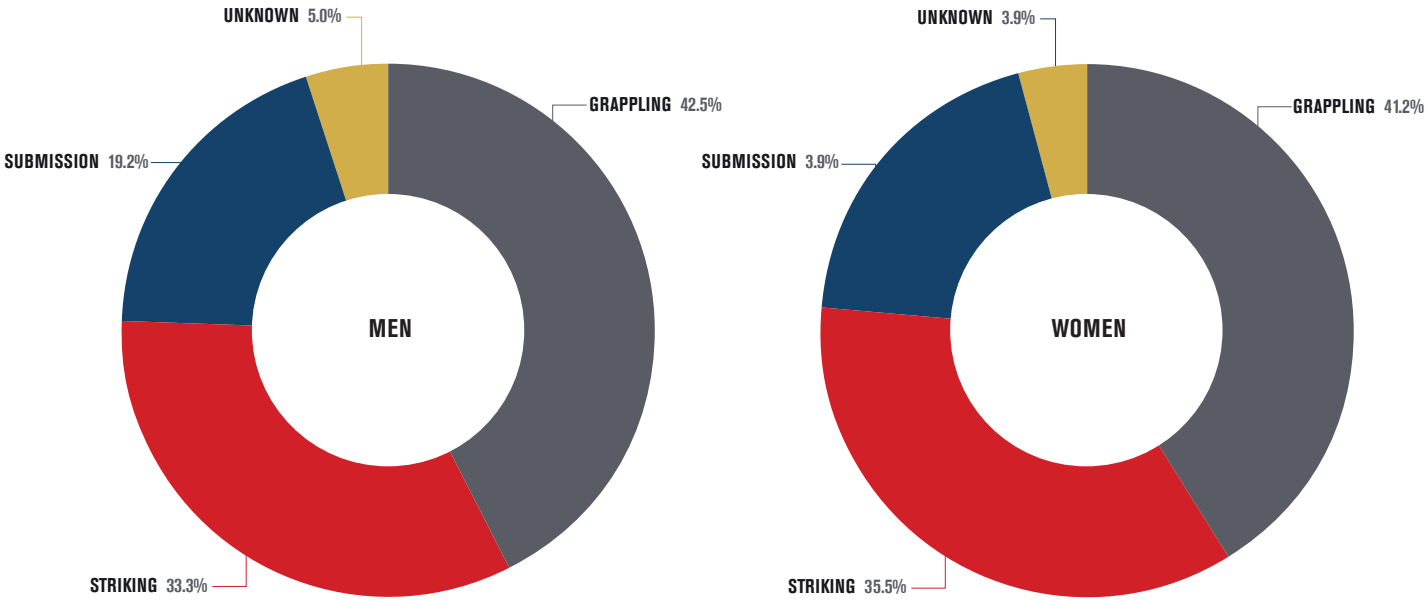


FIGURE 2.5

MECHANISMS OF INJURY DURING TRAINING AND PRACTICE IN MEN AND WOMEN



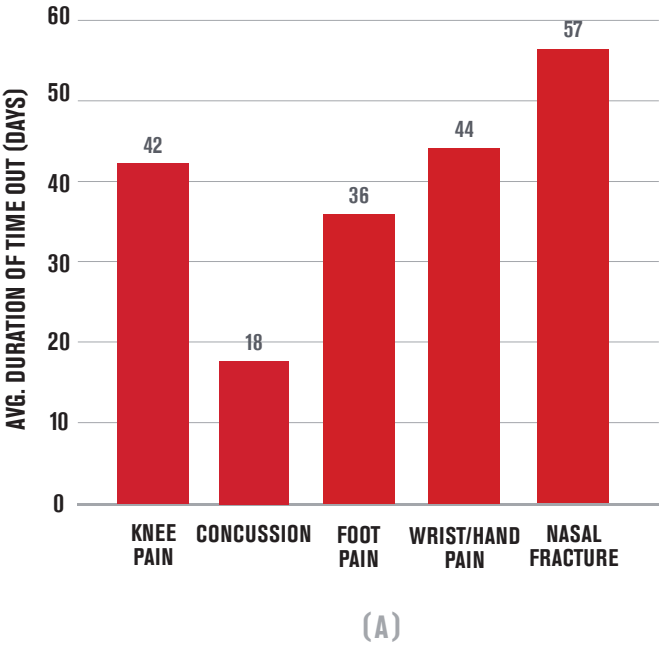


INJURY DURATION

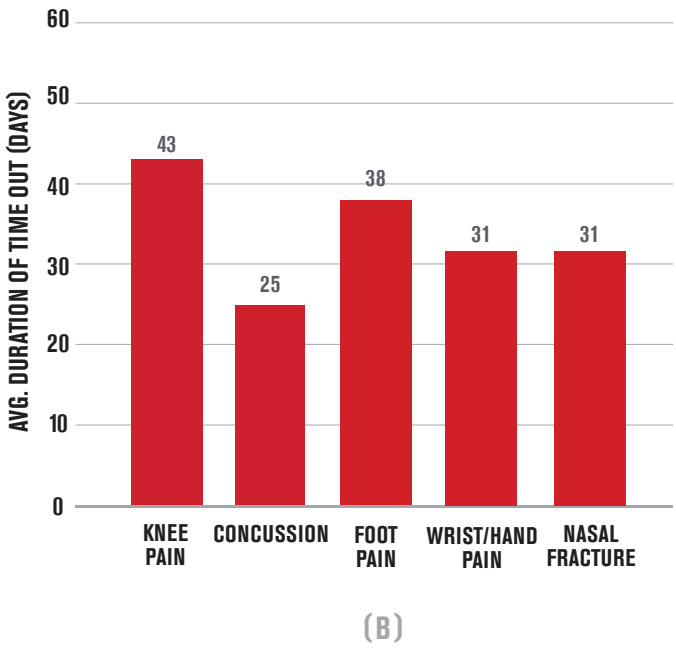
Another important component of injury tracking is the time lost due to injury, i.e., the duration that an athlete is "out" and unable to train or compete. Our data indicates that the average rehabilitation time for the most frequent injuries in MMA fighters is 39 days for men and 33 days for women. It is important to consider that when injuries are managed by a multi-disciplinary team, the time lost due to injury can be reduced. Figure 2.6 shows the average duration of time out from MMA training and competition for the five most frequent injuries in both men and women fighters.

FIGURE 2.6

AVERAGE DURATION (DAYS) OF TIME OUT DUE TO INJURY FOR THE FIVE MOST FREQUENT INJURIES IN MEN (A) AND WOMEN (B)



(A)



(B)



INJURY DIAGNOSIS

To better understand different trends in men's and women's fighter injuries, the 10 most frequent diagnoses for men and women are presented in Figure 2.7. There are similarities between genders with respect to diagnosis of injury.

FIGURE 2.7

TOP 10 INJURY DIAGNOSES IN MEN AND WOMEN

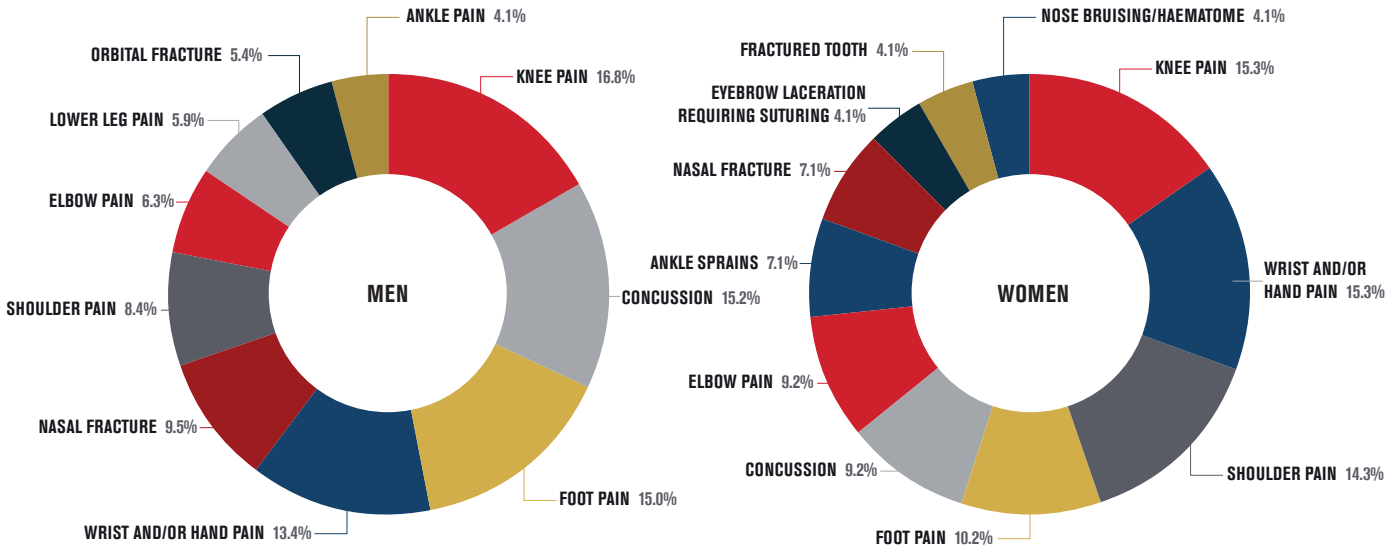
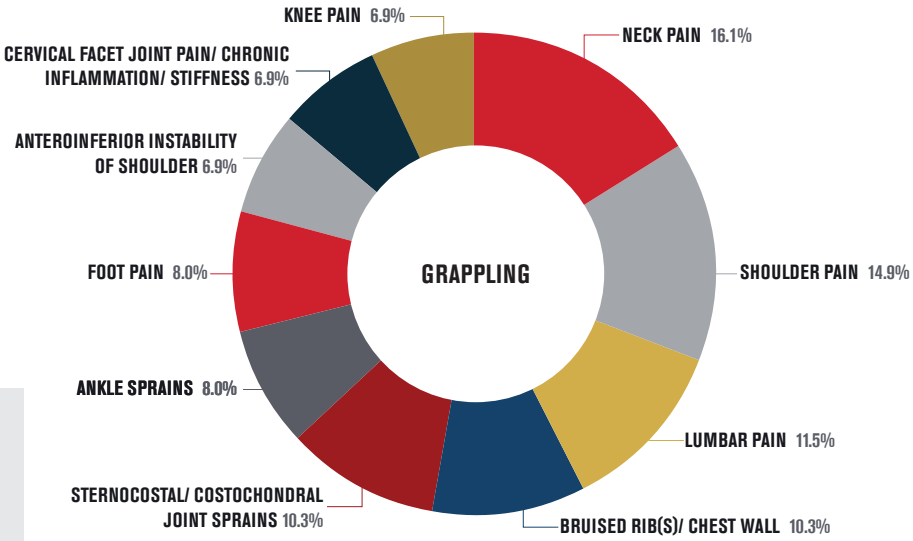
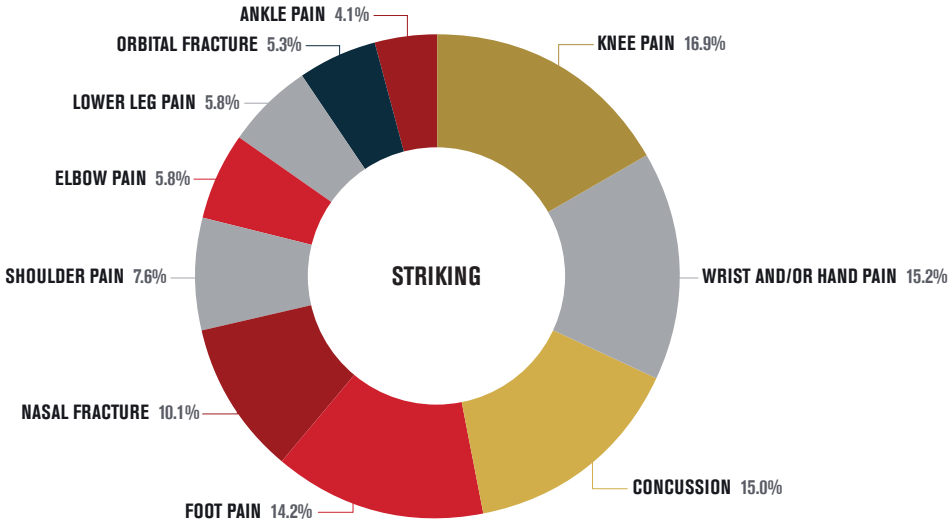
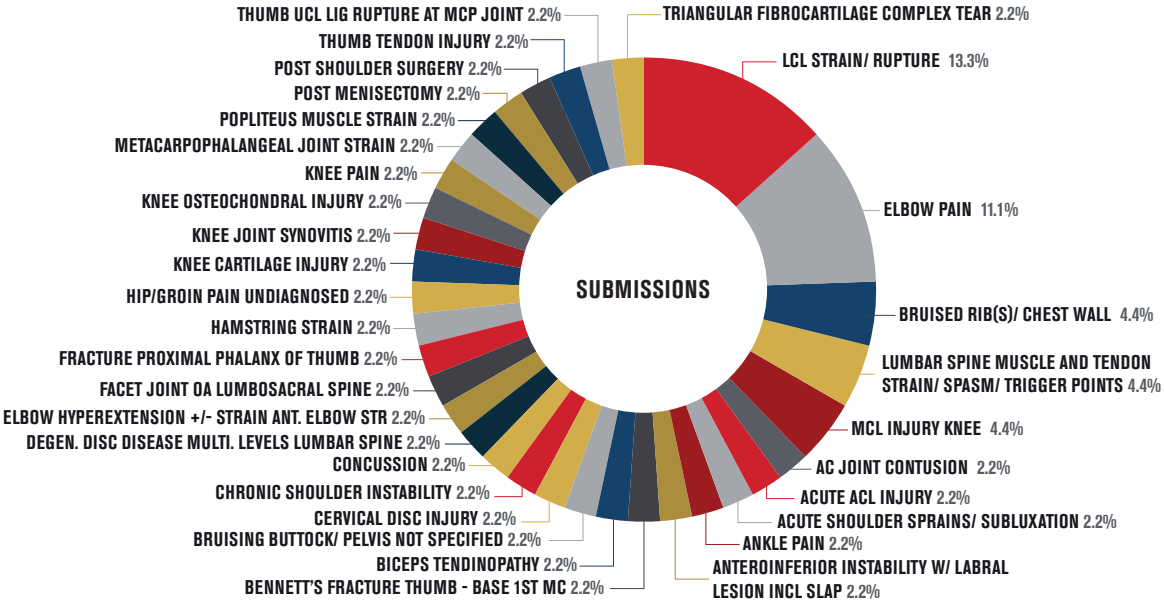


FIGURE 2.8

TOP INJURY DIAGNOSES CONSEQUENT TO GRAPPLING, STRIKING AND SUBMISSIONS







INJURY DIAGNOSIS BY MECHANISM

When examining the injury diagnoses by the mechanism of injury (See Figure 2.8)—excluding cuts, abrasions and lacerations—the primary diagnoses experienced from grappling are neck, low back and shoulder injuries. Striking-related diagnoses were knee pain, wrist/hand pain, concussions and foot pain. And finally, and somewhat expectedly, the top diagnoses from submission techniques included knee and elbow injuries that usually involve ligament sprains.

CONCUSSION AND BRAIN INJURY

Over the past two decades, concussion care and the management of brain injury has been increasingly in demand. Indeed, research and media attention has shed light on the importance of proper diagnosis and medical management of traumatic brain injury. The purpose of exploring this data is to discuss the future of clinical concussion care under the broad themes of diagnosis/assessment, intervention/treatment and patient characteristics with the intent to direct clinician's attention to important factors for MMA fighters. Please note, the data presented here was acquired using C3 Logix software.

At the foundation level, a symptom score is adopted using a standardized symptom evaluation. Symptoms are graded on a scale from 1 to 6, and a composite severity score is acquired out of 22 different symptoms and a maximal 132 total severity score. In addition, the standardized assessment of concussion (SAC) score represents the industry-standard assessment. This evaluation includes assessments of cognitive processing for short-term memory, orientation, focus, and attention.

The vestibular system (inner ear balance mechanism) works with the visual system and is an area that can be significantly impacted by concussion symptoms. Consequently, an assessment of balance is also an important measure in the diagnosis of concussion. The balance error scoring system (BESS) tests six individual conditions for 20 seconds each, all performed with the eyes closed. They include: i) double-leg stance (feet together) on a firm and unstable foam surface, ii) single-leg stance (non-dominant foot) on firm and foam surface and iii) tandem stance (non-dominant foot to the back) on firm and foam surface. Accelerometers are used to review sway, and scores from 0-60 are awarded—with lower scores indicative of better balance performance. Average results are presented in Table 2.3.

The trails making test (TMT) has two parts (A and B) which require athletes to connect numbers and letters in various sequences at speed. These tests are an assessment of fine-motor movement, working memory, planning, sequencing, set-shifting and other cognitive functions. Tests are scored not only by accuracy but also by the duration of time it takes to complete a task. Average scores for UFC fighters are presented in Table 2.4.

Finally, reaction time (RT) and visual acuity are measured. Simple RT is represented by the response to a single stimulus. Choice RT is the reaction to multiple stimuli, and visual acuity represents the ability to identify static and dynamic objects with the comparison between each other the vestibular-ocular response.

TABLE 2.2
AVERAGE SYMPTOM SCORES AND STANDARDIZED ASSESSMENT OF CONCUSSION (SAC) SCORES IN UFC FIGHTERS

SYMPTOM SEVERITY SCORE (general population score ~2)	
Men	Women
12.23	15.40

SAC SCORE (general population score ~26)	
Men	Women
35.4	34.28

This includes baseline and incident assessments

TABLE 2.3
AVERAGE BALANCE ERROR SCORES (BESS) IN UFC FIGHTERS

BALANCE ERROR SCORING SYSTEM (BESS, general population score 11-13)	
Men	Women
14.25	13.31

TABLE 2.4
AVERAGE TRAILS MAKING TEST (TMT) A AND B AND PROCESSING SPEED IN UFC FIGHTERS

TRAILS A (sequencing, general population score 29s)		
Average Normal Value: 29 sec	Men	Women
	14.25	13.31

TRAILS B (patterns, general population 75s)		
Average Normal Value: 75 sec	Men	Women
	48.82	43.25

PROCESSING SPEED (general population 56s)		
Average Normal Value: 56 sec	Men	Women
	57.66	68.14


UFC



PART 1

SECTION 3



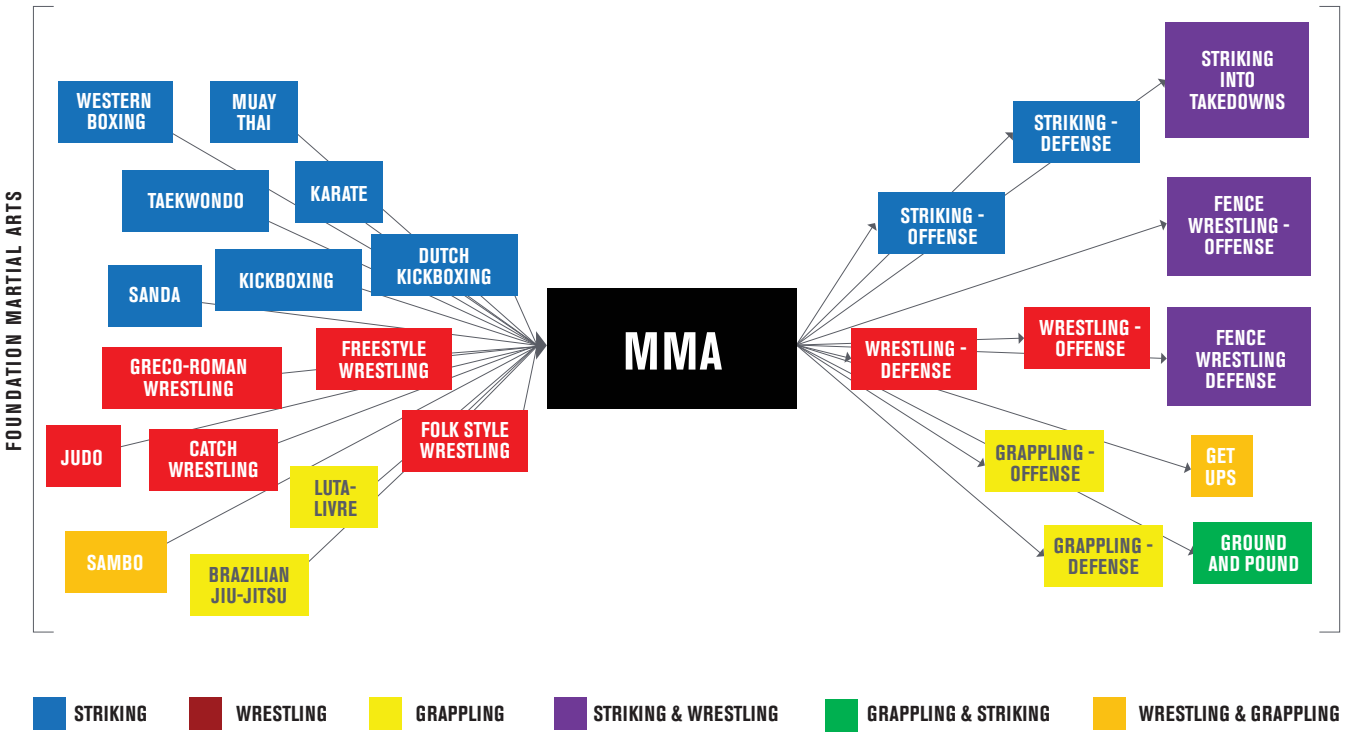
SECTION 3: FIGHTER ANALYSIS

By Forrest Griffin, Dean Amasinger and Richy Walsh

In order to evaluate a fighter in the technical skills required for mixed martial arts (MMA), it is important to first understand that MMA has quickly evolved from many different fighting styles in a short period of time. The combination of these different styles makes MMA highly complex by nature, with each fighting style requiring its own unique techniques and proficiencies. Figure 3.1 provides a representation of the traditional martial arts that underpin the sport of MMA (left side of the figure), as well as the critical skills that are the foundation of MMA itself (right side). While understanding these respective skills is important, it only become valuable when a fighter compares their technical abilities against the highest standards (i.e., a 'gap' analysis), as shown throughout Section 1. The evaluation of technical skills represents a critical component in the process. Indeed, simply noting a fighter's win-loss record is not always a good representation of their technical ability but instead is a measure of 'performance' relative to their opposition. For example, some fighters have high technical abilities yet possess a poor fight record (due to match-ups, their level of opposition or skill at the time of the fight). Others with low technical skills find ways to win because of conditioning, toughness and durability or favorable match-ups.

FIGURE 3.1

FOUNDATIONAL SKILLS FOR THE SPORT OF MMA



STRIKING, **WRESTLING** and **GRAPPLING** on the right side represent techniques that could be taken from any of the corresponding foundation martial arts. If an athlete were only to train these martial arts, he or she could have a comprehensive skillset in striking, wresting or grappling.

STRIKING & WRESTLING, **GRAPPLING & STRIKING**, and **WRESTLING & GRAPPLING** represent techniques unique to MMA that have developed since the sport's inception. These techniques blend the traditional martial arts and are necessary because of the environment in which the fights take place (the Octagon) and also the rules and scoring criteria that are unique to MMA.

"THE EVALUATION OF A FIGHTER'S TECHNICAL SKILLS IS AN IMPORTANT PROCESS WHICH ALLOWS COACHES AND FIGHTERS TO BETTER UNDERSTAND THEIR CURRENT STANDARDS AND TO CONSEQUENTLY STRATEGIZE WHICH AREAS NEED IMPROVEMENT.

The evaluation of a fighter's technical skills is an important process which allows coaches and fighters to better understand their current standards and to consequently strategize which areas need improvement. A **skills evaluation** can be performed by coaches and the fighters. However, it is not recommended that a fighter performs an evaluation on him or herself without a coach's input, as an external perspective is usually required. Optimally, the coach and fighter compare their evaluation notes in order to better understand where they are aligned in their perceptions of the skill levels.

TABLE 3.1

FUNDAMENTAL SKILLS CATEGORIES

1. OFFENSIVE STRIKING

- Stance
- Footwork
- Movement
- Posture (head, hands, body, feet)
- Octagon awareness
- Technical proficiency: Punching, elbows, knees, kicks
- Area of attack: Head, body, leg
- Combinations of techniques: Strike selection, flow
- Non-contact techniques: Feints, traps, fakes
- Power, speed, volume
- Variety in methods: Striking at distance, striking at medium range, striking in short range, jumping, spinning
- Striking from Clinch- Punching (dirty boxing), knees and elbows (Thai clinch)

2. STRIKING DEFENSE

- Guard
- Footwork
- Head movement
- Octagon awareness
- Blocking, slipping, parring, catching
- Counter striking: Timing, distance, controlling range

3. STRIKING INTO TAKEDOWNS (ENTRIES)

- Technical proficiency – of strikes and how to tailor them to set up takedowns
- Timing: Shooting when opponent is defending strikes
- Setups: Strikes to clinch or shot
- Transition into shot: Speed, power, angle, flow, range, distance

4. WRESTLING OFFENSE (SHOTS & CLINCH)

- Technical proficiency – lower-body shots, upper-body clinches and throws
- Posture on entry – head position, hip angle, hand position, foot position
- Pummeling – underhooks/ overhooks, transitions
- Timing – shooting or initiating the clinch on opponent's movement or strikes
- Power, speed, drive, angle of shots
- Chain wrestling: Smooth transition from one attack to the next

5. WRESTLING DEFENSE (SHOTS & CLINCH)

- Sprawls - body position, head position, foot position, hip pressure
- Awareness, reaction speed, timing
- Chain wrestling – ability to defend multiple attacks
- Pummeling – stopping/ denying underhooks, overhooks & re-pummelin for position
- Striking on the break- successfully landing strikes after stopping a take down thus preventing a reshoot
- Strength (explosive vs endurance)
- Attitude – urgency, unwillingness to accept takedowns

6. FENCE WRESTLING (OFFENCE)

- Technical proficiency – leg attacks, upper body attacks
- Pummeling - position of the head, hips, and hands
- Control – ability to keep opponent on fence
- Chain wrestling – smooth transition from one attack to the next
- Strength (explosive vs endurance)

7. FENCE WRESTLING (DEFENSE)

- Pummeling- position of the head, hips, hands
- Reverse position or fence escape
- Chain wrestling – ability to defend multiple attacks
- Strength (explosive vs endurance)
- Attitude – unwillingness to accept takedowns or position (back against fence).

8. GET UPS

- Attitude – urgency, unwillingness to accept takedowns or position, perseverance
- Chain wrestling – ability to defend multiple attacks
- Technical proficiency – guard, half guard, side mount, against the fence, front headlock, turtle, etc.

9. GROUND AND POUND

- Posture: Strength, head position, hip angle
- Striking as a setup for submission
- Strike selection: Elbows, punches, hammer fists
- Wrist control: Grips, position
- Power, speed, volume
- Area of attack – head, body, thigh

10. GRAPPLING OFFENSE

- Control: Top pressure, ability to keep opponent down, obtaining and maintaining dominant position
- Movement: Transitions, riding ability
- Passing: Standing, guard, half guard
- Submissions: Setups, finishing, transitions

11. GRAPPLING DEFENSE

- Posture and positioning: Position of the body, legs, hips and hands
- Hip activity
- Recovery from dominant to neutral positions
- Submissions: Awareness, avoidance, defense, escapes
- Anti-ground and pound: Hand control, framing (shin and forearm position), thumb blocks

Following on from the data presented in Section 1, below are 11 categories that encompass the major skills required within UFC today (see Table 3.1). While it is not essential that every fighter needs to be excellent in all these major skills, it is fundamental that all fighters have a sufficient level of competency in these skills so as to not have an area that could be exposed by an opponent as a major weakness.

As offensive styles and techniques become more prevalent, and the defense against these styles becomes more established, the evolution of technical skills within UFC becomes apparent. The evaluation of a fighter and his or her respective skillset then becomes more complex and it is critical that coaches establish a robust approach to fighter evaluation. Here, we present an overview of the methods used by the UFC PI to conduct a comprehensive evaluation of skills in MMA fighters.

FACTORS TO CONSIDER PRIOR TO SKILLS EVALUATION

MMA fight record. This will give a good level of overall MMA training age and level of opponent.

Record in other combat sports. This will give insight into a fighter's original base, what he or she is most comfortable with and what he or she will fall back on in high-intensity situations.

Previous gyms/coaches. This will provide knowledge and a good conversation starter of what types of practice and coaching style a fighter is most used to or comfortable with.

Amateur/collegiate history. Similar to the record in other combat sports, this will give an indicator as to the style a fighter is most used to (e.g., a collegiate wrestler will have a much different practice expectations then an Olympic-level taekwondo champion).

Biological and training age along with time in and time left in sport. All this information will help set the development plan for a fighter because it requires a consideration of how many more fights or years in professional MMA a fighter has. For example, if a fighter is older, he or she may concentrate less on strengthening their weaknesses and more on harnessing the skills that have served them well in the past.

Goals/Potential. This is a discussion of a fighter's realistic expectations, ultimate potential and where he or she would like to be in the sport by career's end. If a fighter truly wants to be great, he or she may need to take time away from competition to spend time developing all parts of their MMA skillset.

Injury history. This may limit the type of training a type a fighter is able to do (e.g., if a fighter has had multiple knee surgeries, they may not be able to practice double-leg shots and will need to learn alternatives for competition.)

SKILLS EVALUATION PROCESS

Figure 3.2 shows the MMA skills evaluation tool utilized by the UFC PI to evaluate the technical standards of a single fighter (i.e., fighter X). The 11 technical areas serve as a guide to structure a coach's evaluation of all the respective areas of MMA, as well as a fighter's ability to combine them successfully. Each technical area can be broken down and evaluated individually. To formalize this approach, technical areas are given scores out of 10 for each of the four categories and average to give an overall score for that technical area. From this evaluation, a training plan can be designed based on the fighter's strengths and weakness for optimal competitive performance.

FIGURE 3.2
MMA SKILLS EVALUATION TOOL

STRIKING: OFFENSE			
FOOT WORK/STANCE	6	VARIATION/TECHNIQUE	7
Light on his feet. Good movement. Sometimes has a little too wide of a stance. Sometimes leaves his feet behind him when throwing combinations.		Has a good selection of shots. Some unorthadox strikes and "flashy" techniques. Needs work on his boxing technique.	
POSTURE/BALANCE	5	POWER	7
Use of unorthodox and "flashy" moves. He can sometimes lose his balance and be out of position.		He has good power in all his strikes but could still develop his punching power by improving his balance and posture.	

STRIKING: DEFENSE			
HEAD MOVEMENT	3	BLOCKING/SPARRING	4
In his eagerness to land his strikes, he can forget to move his head and can be easy to hit.		Has a simple but effective blocking game. Sometimes covers up too much and leaves himself open to takedowns. He doesn't really parry or catch but does use on occasion.	
FOOTWORK	6	COUNTERS	6
His best attribute defensively is his footwork. Due to his athleticism, he is able to move out of danger and has good lateral movement.		He doesn't use tight counters or head movement to counters, but he will use footwork to get out of danger and back into range to land shots and is effective with it.	

STRIKING INTO TAKEDOWNS			
TIMING	7	PUNCH TECHNIQUE	6
Mixes punches into strikes well. Smooth transitions.		His level change needs to be better and can sometimes put him up in bad positions.	
POSTURE/POSITION	6	POWER/SPEED/DRIVE	7
His level change needs to be better and can sometimes put him up in bad positions.		He's explosive and powerful and drives well when he goes for a takedown.	

WRESTLING: OFFENSE			
TIMING	6	POSTION.STNACE/TECH	5
Has good timing but sometimes doesn't set things up and can be in bad positions. Does best when he uses strikes.		Realies on his athleticism rather than technique.	
POWER/SPEED/DRIVE	7	CHAIN WRESTLING	4
He's explosive and powerfull and drives well when he goes for a takedown. Does not cut the corner on his double leg.		Still needs to develop his chain wrestling particluarly with the single leg.	

WRESTLING: DEFENSE			
AWARENESS	6	HIPS	7
He has good awarenss for the first shot but can get taken down if people chain well.		Strong hips. Uses them well. Sometimes too much and makes chain wretsling easier.	
SPEED/URGENCY	7	TECHNIQUE	6
Understands anti clinch mentality and can be effective at working quickly to break once td are defended.		Good grasp of fundementals. Sometimes forgets to stuff the head and to hand fight.	

GET UPS			
SPEED/URGENCY	6	ATTITUDE	7
Good speed and urgency.		Does not accept takedown.	
CHAIN	4	SWEEPS	4
Will work well to get up but doesn't do well against multiple attacks.		Lacks the ability to sweep.	

Ideally, this evaluation process should initially occur off-camp when no fight is scheduled, although it will continue to happen informally throughout fight preparation. By completing it initially in off-camp, the fighter has adequate time to work on the skills that need improving (e.g., their weaknesses) without having to concentrate on skills that will be more utilized or needed for an upcoming bout (e.g., their strengths or specific to an upcoming opponent).

While the dynamics of the fighter-coach relationship vary greatly, a coach and fighter should be able to review the results of their skills evaluation together and develop a plan that will improve the fighter's technical weaknesses and maximize strengths. This can also be done with any specific discipline coaches (e.g., wrestling coach) evaluating a field of expertise and reviewing that information with head coach and the fighter.

FENCE WRESTLING: OFFENSE			
POSTION/TECH	5	HEAD POSITION	5
Tries to use strength too much. Ok technique.		Gets out of position quite often. Doesn't use his head as often as he could.	
STRENGTH	7	CHAIN	5
Strong. Can get people down with determination.		Only one attempt at a time but does break off well and transition to strikes.	

FENCE WRESTLING: DEFENSE			
AWARENESS	7	HIPS	8
Has good awarness and seems to be able to stop the first attempt. Struggles with good chain wrestling.		Strong hips. Uses them well and makes it hard to get hands together.	
TECHNIQUE	6	SPEED/URGENCY	7
Good grasp of fundementals. Sometimes forgets to stuff the head and to hand fight.		Quite good at getting off the fence. Does not rest on fence.	

GROUND AND POUND			
SHOT SLECTION	6	POSTURE	6
Good shot selection. Uses traps and wrist control.		Has good posture but doesn't use technique to get it. Will force out of head control, etc.	
CONTROL	5	POWER	7
Can forget about control when striking. Doesn't use his body as well as he could. Has good submission awareness.		Creates good power with his strikes and understands using his body to create force.	

GRAPPLING: OFFENSE			
PRESSURE/CONTROL	6	PASSING	5
Good pressure and control. Can keep positions well but needs to work on his mount.		Ok passing but sometimes gives too much space and rushes the pass.	
TRANSITIONS	6	SUBMISSION	5
Good transitions from position to position and from punching to position/pass.		Ok submissions but doesn't set them up well. Has a strong kimura.	

GRAPPLING: DEFENSE			
FRAMES/POSTURE	4	AWARENESS/SUB DEFENSE	5
Stiil doesn't use his frames enough. When he does, they're strong but it isn't instinctive yet.		Very difficult to submit. Good awareness of bad positions and how to escape.	
ANTI-GNP	6	POSITION/BASE	5
Has good posture but doesn't use technique to get it. Will force out of head control, etc.		Difficult to sweep. Can sometimes leave his neck out in positions and can be vunerable to the guillotine.	

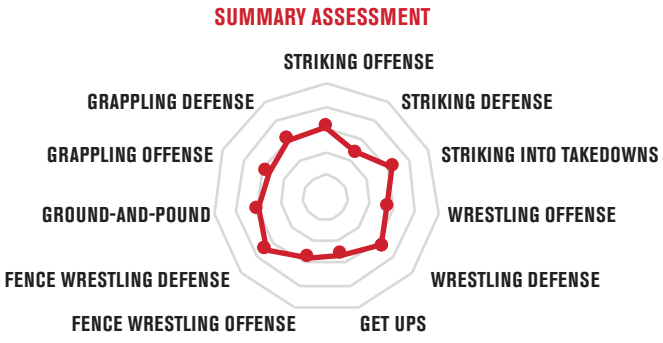


Table 3.2 is the intellectual property of Dean Amasinger


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TABLE 3.2
EXAMPLE EVALUATION WEEK STRUCTURE

MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
MORNING					
WRESTLING/FENCE WRESTLING POSITIONAL LIVE GO'S HIGH INTENSITY EVAL: 4, 5, 7, 8	STRIKING OFFENSIVE/DEFENSIVE DRILLS MEDIUM INTENSITY EVAL: 1, 2	POSITIONAL GRAPPLING POSITIONAL LIVE GO'S LOW INTENSITY EVAL: 6, 10, 11	STRIKING MMA SPARRING HIGH INTENSITY EVAL: 1, 2, 3, 6, 9	WRESTLING GRAPPLING MEDIUM INTENSITY EVAL: 10, 11	LITTLE GLOVE SPARRING HIGH INTENSITY EVAL: ALL TECHNICAL AREAS
EVENING					
STRIKING BAG/MITTS LOW INTENSITY EVAL: 1, 2	STRIKING INTO TAKEDOWNS MMA GRAPPLING MEDIUM INTENSITY EVAL: 3, 6	REST/RECOVER	MMA WRESTLING TECHNICAL DRILLING LOW INTENSITY EVAL: 10, 11	TECHNICAL STRIKING DRILLS LOW INTENSITY EVAL: 1, 2	REST/RECOVER

This is an example MMA practice week designed to evaluate all of the skills utilized in MMA. These practices should be high quality and low duration. The evaluation numbers refer to the associated technical areas in the MMA skills evaluation (Table 3.1). These technical areas represent a framework to evaluate the skills most utilized in MMA at the UFC level.

An example evaluation week is presented in Table 3.2 and reflects a first week of training in which all skills will be utilized. The volume of this practice week can be increased or decreased based on the fighter's physical preparedness for MMA training. The general theme of the week is to get a brief, yet effective, assessment of each skill used in a non-fatigued state against partners of a similar size and skill level. In addition, a sparring assessment should be completed to see how a fighter is able to blend these skills together in a live environment with consequences.

After completing the evaluation week, it becomes possible to identify the primary technical areas that will shape the technical training plan moving forward. The spider graph reflects a general representation of the fighter's overall technical competence and a further breakdown can highlight technical areas that are below identified standards and need the most improvement.


UFC



PART 1

SECTION 4


PERFORMANCE
INSTITUTE

SECTION 4:
ASSESSMENT & DIAGNOSTICS: TEST SELECTION

By Kyle Larimer and Roman Fomin

When developing a training plan for an athlete, it is essential that consideration is given to both the technical and non-technical demands of the sport. Training plans should be built using both technical (e.g., MMA) and non-technical (e.g. strength and conditioning, medical and nutrition) evaluations, such that insights can be used to accurately shape training strategies. Indeed, assessments to diagnose critical factors that can be i) used to direct training and ii) create measurable key performance indicators (KPIs).

Assessments help coaches identify areas that have the largest windows of opportunity for development, as well as to understand the progressions and/or regressions in technical and non-technical adaptations (e.g., increases or decreases in a metabolic power). Further insight can be gained by distinguishing between short-, moderate- and long-term training adaptations. For example, tracking shorter-term adaptations (e.g., metabolic or neuromuscular fatigue) can allow coaches to better manage the challenges of an individual fight camp. Meanwhile, evaluating longer-term adaptations can help to monitor progressions throughout an athlete's career (e.g., are the fighter's technical skills or physical capacities improving?)

"IF YOU'RE NOT ASSESSING, YOU'RE GUESSING!"
- DUNCAN FRENCH

VALIDITY AND RELIABILITY

When performing any test or assessment, a series of fundamental considerations must be accounted for in order to ensure quality data:

VALIDITY

For tests to be valid, it must measure what it is specifically intended to measure. This is important if the results are to be meaningful and applicable to relevant factors.

RELIABILITY

Reliability represents the overall consistency of a measure. Highly reliable tests produce similar results under similar conditions so that all being equal, any change in a result is likely from a specific adaptation.



PRIMARY ASSESSMENTS

When deciding what assessments to utilize with MMA fighters, the first step should be to understand the needs of the sport. Technical and tactical skills evaluation has been addressed in detail in Section 3. Elsewhere, MMA requires a wide array of physical qualities, so the evaluation of each of these qualities should all be accounted for when assessing an athlete. Creating a standardized assessment battery is beneficial for tracking athlete progress and comparing fighters to population norms. Table 4.1 gives a comprehensive overview of the technical areas of the UFC PI and an insight into some of the primary assessment domains targeted within each of them.

In performing assessments, consideration should be given to the number of athletes being tested, the equipment available, the need to produce valid and reliable data and the performance standards of the athlete(s). For example, a group of 10 young amateur fighters may require modified assessments when compared to a single professional UFC fighter. Further to this, it is acknowledged that it is unlikely that all athletes, coaches and gyms will have access to high-level technology and testing equipment. Testing on a budget or with limited resources therefore becomes a critical consideration and this is addressed in more detail in Section 5.

Optimizing the assessment schedule will also help get the most out of any assessment process. Assessment days (or weeks) should be structured to promote both efficiency and consistency in data collection. When repeating an assessment, especially performance assessments such as an isometric mid-thigh pull or VO2max, there should be an attempt to perform each test at the same time and on the same day of the week that they were completed previously. This will limit the variables affecting the assessment results (e.g. training fatigue, sleep, diet). Additionally, it should be understood that one assessment may affect another if not ordered correctly. Tests that impose less metabolic stress on the athlete or that act as prerequisites to other tests should be placed at the beginning of the testing schedule. For example, performing an exhaustive energy system assessment such as a VO2max or “beep test” before a maximal mechanical power assessment like a counter-movement jump is likely to affect the results of the power assessment. Another example is a countermovement jump would normally be performed before the loaded countermovement jump profile and any maximal strength assessment.

TABLE 4.1
UFC PI TESTING DOMAINS

STRENGTH, SPEED AND POWER		
FOCUS	**TEST**	**KEY METRICS** (not a complete list)
GRIP STRENGTH	10-SEC GRIP DYNAMOMETER	PEAK FORCE, AVERAGE FORCE
LOWER BODY POWER	COUNTERMOVEMENT JUMP	JUMP HEIGHT, PEAK POWER
LOWER BODY POWER PROFILE	LOADED COUNTERMOVEMENT JUMP PROFILE @ 15%, 30% AND 60% BODY WEIGHT	PEAK POWER, RATE OF FORCE DEVELOPMENT, FORCE-VELOCITY
MAXIMAL STRENGTH	ISOMETRIC MID-THIGH PULL	PEAK FORCE, RATE OF FORCE DEVELOPMENT
UPPER BODY POWER	LANDMINE PUNCH THROW	PEAK FORCE, PEAK VELOCITY, PEAK POWER, FORCE-VELOCITY IMBALANCE
MAXIMAL ALACTIC POWER (MAP)	REPEATED SPRINT PROFILE OR UPPER BODY ERGOMETER SPRINT	PEAK POWER, RELATIVE AVG. POWER
GLYCOLYTIC POWER (MGP)	3MIN BIKE SPRINT	PEAK POWER, AVERAGE POWER
AEROBIC CAPACITY	VO2MAX TEST (TREADMILL OR BIKE)	VO2PEAK, VENTILATORY BREAKPOINTS
NUTRITION & BODY COMPOSITION		
ANTHROPOMETRY	ISAK ANTHROPOMETRICAL MEASURES	WEIGHT, STATURE, LIMB PORTIONS
BODY COMPOSITION	IDXA	LEAN MASS, FAT MASS, BONE MINERAL DENSITY, LIMB ASYMMETRY
METABOLISM	INDIRECT CALORIMETRY	RESTING METABOLIC RATE (RMR, CALORIE EXPENDITURE)
METABOLIC EFFICIENCY	METABOLIC EFFICIENCY TEST (TREADMILL)	SUBSTRATE UTILIZATION
PHYSICAL THERAPY		
FUNCTIONAL MOVEMENT	MOVEMENT SCREEN	MOBILITY, RANGE OF MOTION
BRAIN INJURY/CONCUSSION	C3LOGIX PRE-CONCUSSION BASELINE	VESTIBULAR FUNCTION, WORKING MEMORY AND COGNITIVE PROCESSING
SPORT SCIENCE		
READINESS AND TRAINABILITY	OMEGA-WAVE	HEART RATE VARIABILITY, ELECTROCARDIOGRAM, DIRECT CURRENT POTENTIAL

SECONDARY ASSESSMENTS

Not all physical qualities will need to be consistently tested, and some tests from the primary assessment battery may not always be appropriate for all athletes. Indeed, there may be instances in which a physical quality that is not evaluated in the primary assessments is identified later through other means to be a potential barrier for improved performance. For example, balance is important in MMA but may not be considered as a primary assessment. However, if an athlete is observed to struggle when balance is called upon during skills training, an additional assessment of balance may become beneficial. Elsewhere, some athletes may not be comfortable with an aspect of an assessment or may have an injury history that prevents them from performing certain assessments. For example, it is possible that an athlete who is not comfortable performing high-speed running using a treadmill could still perform a VO2max assessment on a bike. Creating a secondary assessment battery can provide coaches with additional, pre-prepared assessments that can be used in these situations and will ensure practitioners are still collecting the necessary information needed to optimally individualize programs. Example secondary testing domains are presented in Table 4.2

TABLE 4.2
UFC PI SECONDARY TESTING DOMAINS

STRENGTH, SPEED AND POWER		
FOCUS	**TEST**	**KEY METRICS** (not a complete list)
UPPER BODY STRENGTH ENDURANCE	PRONE BENCH ROW @ 50% BW	MAXIMAL REPETITIONS
VISUAL AND SENSORIMOTOR SKILLS	SENAPTEC SENSORY STATION	REACTION TIME, VISUAL CLARITY, HAND-EYE COORDINATION, DEPTH PERCEPTION
NUTRITION & BODY COMPOSITION		
BODY COMPOSITION	BIOELECTRICAL IMPEDANCE (BIA)	LEAN MASS, FAT MASS, TOTAL BODY WATER
PHYSICAL THERAPY		
ISOLATED LIMB/JOINT FORCE	ISOKINETIC DYNAMOMETER	PEAK FORCE @ 60 DEGREES/SEC, PEAK FORCE @ 300 DEGREES/SEC
MUSCULAR ACTIVITY	ELECTROMYOGRAPHY (EMG)	MUSCLE CONTRACTILE CHARACTERISTICS/ACTIVATION
SPORT SCIENCE		
CARDIAC HEALTH AND PERFORMANCE	12-LEAD ECHOCARDIOGRAPHY (ECG)	HEART RHYTHM
MUSCULAR ACTIVITY	ELECTROMYOGRAPHY (EMG)	MUSCLE CONTRACTILE CHARACTERISTICS/ACTIVATION
BIOMECHANICS	VICON MOTION ANALYSIS	JOINT AND LIMB KINEMATICS AND KINETICS
SPORT-SPECIFIC MOVEMENT CHARACTERISTIC	ACCELEROMETERS, GYROSCOPES, MAGNETOMETERS	LIMB OR TRUNK ACCELERATION AND MAGNITUDE E.G. PLAYERLOAD™ ORIENTATION



INFLUENCE OF TRAINING AND COMPETITION PHASE

The primary assessment battery evaluates all physical and physiological qualities when there are little or no time restrictions. While in a fighter's off-camp, multiple days and sessions can potentially be devoted to this process. It is important to use this time to thoroughly profile the athlete in order to get the most out of the off-camp period.

Training phase can have a significant influence over the selection of assessments. If athletes are entering fight-camp, the windows in which to perform any evaluations gets smaller, and training time is precious. Therefore, a testing battery may need to be reduced. The time, effort and energy to perform assessments should not detract from technical training in most instances. This also means the importance of certain tests are lessened while others are potentially increased. Specialist non-technical disciplines such as physical therapy, performance nutrition and/or strength and conditioning will need to review which assessments are implements, when, and why. For instance, if an athlete is identified as having adequate mobility in all areas of a functional movement screen and there are no "red-flags" during a fight preparation, that screen may not be implemented again until the next fight preparation. Meanwhile, if another athlete has substandard mobility on that same assessment, it may call for more regular assessments to ensure that interventions aimed at improving specific mobility deficiencies are impactful.

CONTRAINDICATIONS TO ASSESSMENT AND DIAGNOSTICS

Deciding when not to do an assessment can be just as important as deciding when to do one. As has been noted, not all assessments are appropriate for every situation. Certain factors may make an assessment inadvisable for some fighters. These include non-training factors such as illness, lack of motivation, failure to comply with necessary interventions following an initial assessment or inexperience with the test. These also include training-related factors like athlete injury, training phase and competition schedule. Selecting which assessments to implement and when is multifactorial in nature.



PART 1
SECTION 5

TESTING ON A BUDGET

By Duncan French and Roman Fomin

While the UFC Performance Institute is well resourced with high-level technologies and modern assessment capabilities, this might not be the case for the vast majority of gyms and training facilities. Consequently, to engage in the process of gaining insights into athlete wellbeing and performance, there is the need to administer testing protocols that don't require large budgets or the latest technology, but still provide valuable information for decision making. Below are some fundamental considerations for testing on a budget for MMA, as well as example procedures.

CONSIDERATIONS FOR TEST SELECTION

- **VALIDITY** — Does it measure what it is supposed to?
- **RELIABILITY** — Are the test results consistent?
- **SENSITIVITY** — Does it correctly identify change?
- **EFFICIENCY** — Can it be easily administered?



STRENGTH & POWER

MAX. STRENGTH
1 repetition max. lifts

STRENGTH ENDURANCE
Max. repetition lifts

LOWER BODY POWER
Vertical jump, medicine ball overhead throw for distance

UPPER BODY POWER
Medicine ball seated chest pass

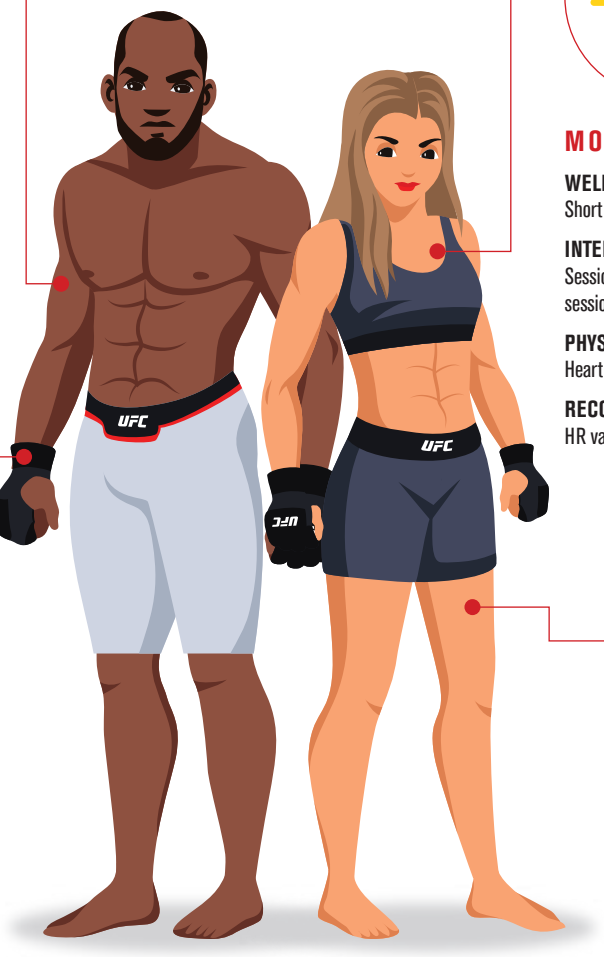


TOOLS & TECHNOLOGY

MEASUREMENTS
e.g. Time, distance, weight, repetitions, speed, power, score

TOOLS
e.g. Tape measure, weight,questionnaires, stopwatch

TECHNOLOGY
Smart device, apps, wearable tech.





MONITORING

WELLNESS
Short recovery and stress scale

INTERNAL TRAINING LOAD
Session rating of perceived exertion (sRPE, 1-10) x session duration

PHYSICAL STRAIN
Heart rate (HR), sRPE (1-10)

RECOVERY
HR variability (smart apps)



ENERGY SYSTEMS

ALACTIC POWER
10s bike peak power, 20m sprint

ANAEROBIC CAPACITY
Running-based anaerobic sprint test (RAST), 500m row, 300yrd shuttle (12x25yrd)

AEROBIC CAPACITY
30-15 intermittent fitness test, YoYo intermittent recovery test, timed run at a set distance


UFC



PART 1
SECTION 6



SECTION 6: ORTHOPEDIC EVALUATION TRENDS

By Heather Linden

Orthopedic assessments allow sports medicine staff to evaluate and fully understand a fighter's body and the way he or she moves during sport. It also allows clinicians to look critically at the orthopedic health and well-being of the fighter which can be used to minimize injury risk. This is done by assessing range of motion (ROM), joint kinematics, strength and other special tests (e.g. neural tension tests, joint laxity tests) along with a comprehensive injury history, which helps identify how previous injuries may hinder or limit a fighter's performance. Over the past three years, the UFC PI has performed 175 (137 men, 38 women) baseline orthopedic assessments on UFC athletes. From these results, we are able to identify trends that are seen among both men and women fighters, as well as compare these to the research based normative values.

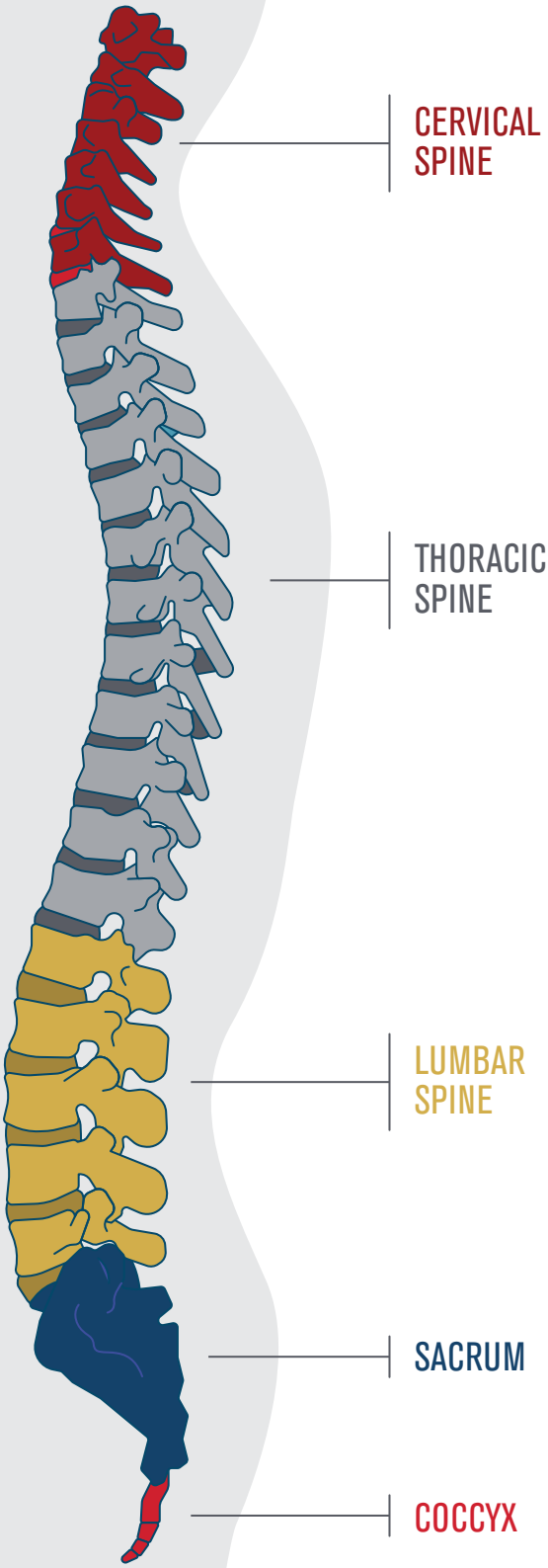


FIGURE 6.1 **SECTIONS OF THE SPINE**

SPINE AND TRUNK

The most significant finding when assessing spine and trunk characteristics (see Figure 6.1) in UFC athletes relates to cervical ROM. Cervical spine rotation occurs primarily between C1 and C2 (accounting for 50% of total cervical spinal rotation) and is done by the intrinsic rotators including oblique capitus (superior/inferior) and the splenus group. When a fighter's extrinsic rotators (sternocleidomastoid, scalenes, levator scapulae, upper traps) dominate over the intrinsic muscles, a reduced range of motion results due to the need to extend or laterally flex during vertical rotation. This leads to a compensatory pattern that can lead to excessive stress, tissue damage and pain, which is found quite frequently when assessing UFC athletes (Table 6.1).

TABLE 6.1
SECTIONS OF THE SPINE

CERVICAL SPINE RANGE OF MOTION			
	M	F	NORM
FLEXION (DEGREES)	47	46	45-60
EXTENSION (DEGREES)	59	60	60
R ROTATION (DEGREES)	67	67	80
L ROTATION (DEGREES)	68	69	80
THORACIC SPINE RANGE OF MOTION			
	M	F	NORM
R ROTATION (DEGREES)	81	75	80
L ROTATION (DEGREES)	80	74	80
SLUMP NEURAL TENSION TEST			
	M	F	
R LOWER EXTREMITY	16%	16%	
L LOWER EXTREMITY	15%	21%	

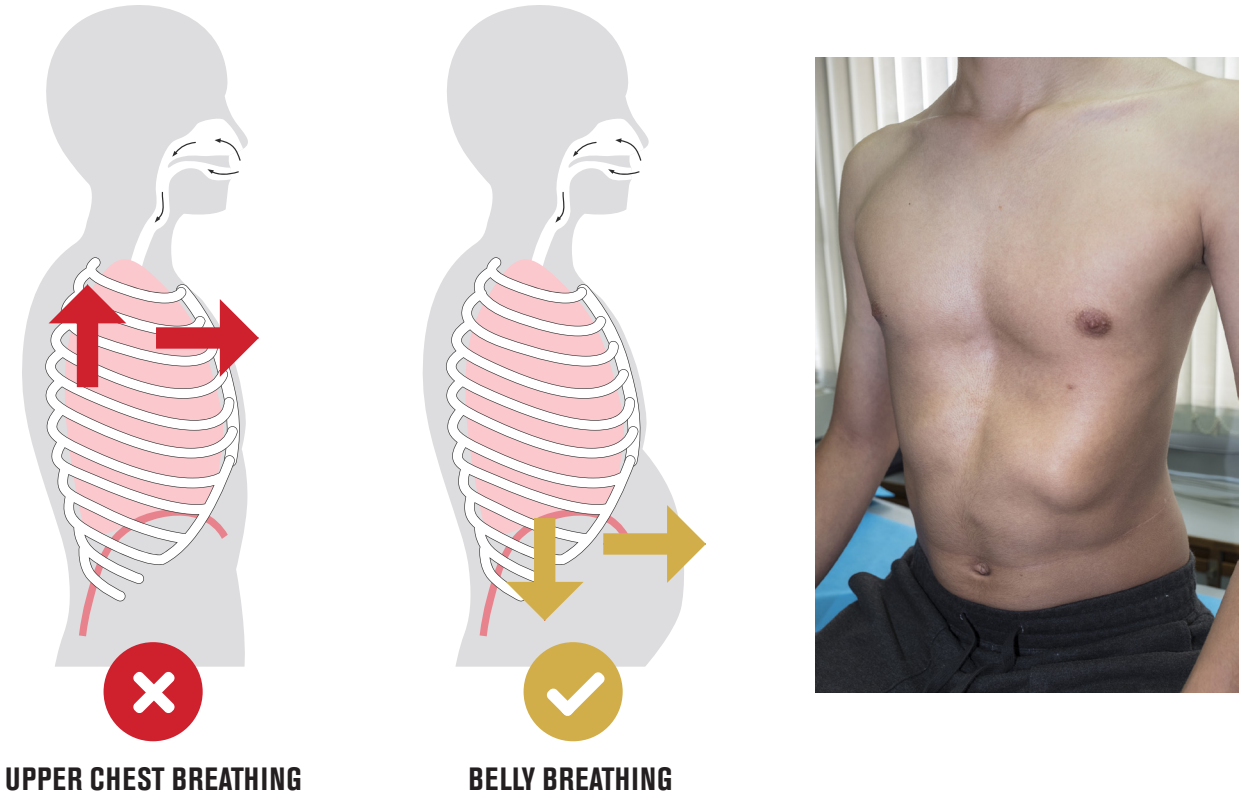


FIGURE 6.2
BREATHING MECHANICS AND EXAMPLES OF RIB FLARE

As we move down to the trunk, a majority of UFC athletes have deficits in their breathing patterns and have positive results when looking at the lateral rib flare. Normal breathing patterns assist athletes not only with cardiovascular performance and mindset but also play a key role in posture and spinal stabilization. When athletes utilize accessory breathing patterns instead of diaphragmatic breathing, pain, motor control deficits and dysfunctional movement patterns can become apparent and hinder performance. With respect to rib misalignment, most postural rib flares occur predominantly on the left side, as this is where internal organs are situated. In fighters who carry "static" air in their lungs and don't learn to fully exhale, the rib flare becomes more predominant. Stress and tension have also been shown to trigger this rib flare due to the inability to fully exhale and carry "static" air in the lungs. If athletes are in a constant state of stress or have poor breathing mechanics, research indicates this can negatively impact performance, posture, injury prevention and rehabilitation (Figure 6.2 and Table 6.2).

TABLE 6.2
SECTIONS OF THE SPINE

BREATHING MECHANICS		
	M	F
ACCESSORY/UPPER CHEST	72%	97%
DIAPHRAGMATIC	64%	74%
LATERAL RIB FLARE		
	M	F
R	15%	75
L	58%	74

TABLE 6.3

UPPER EXTREMITY CHARACTERISTICS

ACROMIUM DISTANCE FROM SURFACE		
	M	F
R (CM)	12	10
L (CM)	12	10

SHOULDER RANGE OF MOTION					
	M		F		NORM
	R	L	R	L	
FLEXION (DEGREES)	173	173	173	172	180
ABDUCTION (DEGREES)	178	177	174	173	180
IR (DEGREES)	64	65	70	72	70-90
ER (DEGREES)	77	76	93	90	90

SCAPULAR DYSKINESIS		
	M	F
R	60%	45%
L	73%	55%

BELLY PRESS (SUBSCAPULARIS FUNCTION UTILIZING OXFORD MANUAL MUSCLE TEST SCALE)		
	M	F
R	4.62/5	4.59/5
L	4.63/5	4.67/5

SHOULDER LAXITY				
	M		F	
		L	R	L
ANTERIOR (DEGREES)		34%	58%	50%
POSTERIOR (DEGREES)		15%	32%	42%
INFERIOR (DEGREES)		17%	29%	34%

LATISSIMUS DORSI RANGE OF MOTION		
	M	F
R (DEGREES)	152	156
L (DEGREES)	153	159

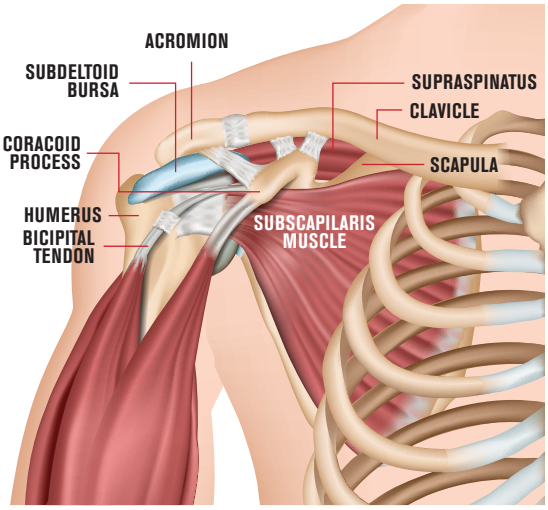


FIGURE 6.3

STRUCTURE OF THE SHOULDER

UPPER EXTREMITY

When assessing the upper extremity, fighters can present with many orthopedic issues. The most common dysfunction is scapular dyskinesis. Scapular dyskinesis is an alteration in the normal position or motion of the scapula during scapulohumeral movements. It occurs from injuries involving the shoulder joint, especially those that result in the inhibition or disorganization of activation patterns in the scapular stabilizing muscles. Scapular dyskinesis is found to be more prevalent in "overhead athletes," which correlates to fighters due to the high volume of upper body striking in MMA training. When we look at shoulder ROM, male athletes are often limited in their rotation, especially external rotation. With poor posture and an anterior humeral position, this also likely contributes to the scapular dyskinesis. Lastly, we see increased anterior instability in the UFC athlete population. Anterior dislocations tend to be the common injury with imbalances between anterior and posterior shoulder muscles being the primary precursor for instability and dislocations (Figure 6.3. and Table 6.3)

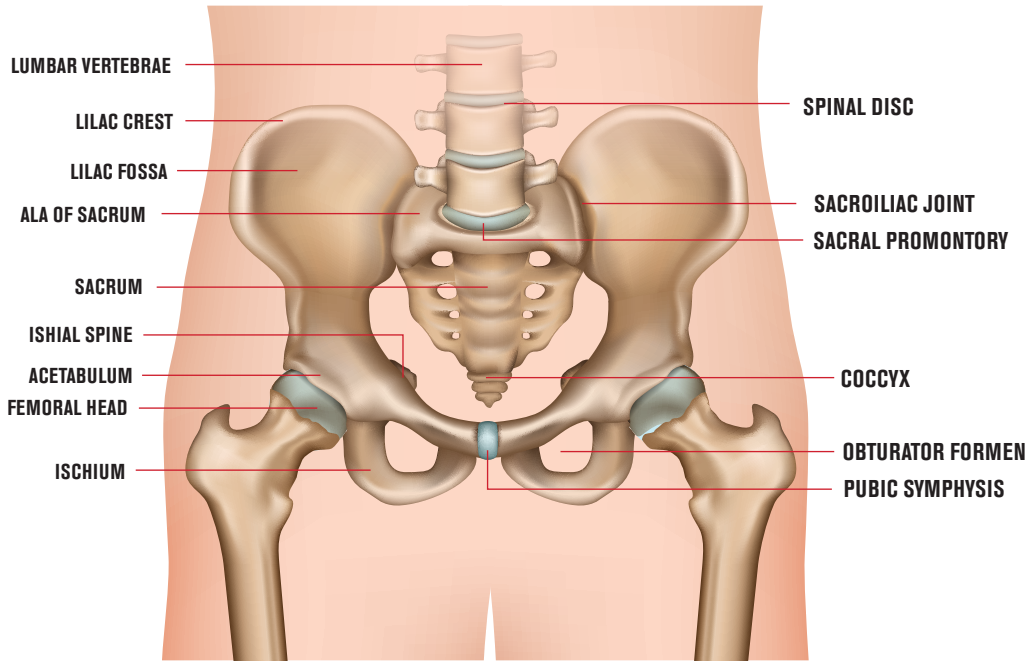


FIGURE 6.4
STRUCTURE OF THE HIP

LOWER EXTREMITY

Over the past three years, there have been a number of improvements in lower-extremity function in UFC athletes. In the first year of UFC PI operations (2017-18), there were several hip and ankle ROM issues with a high propensity of weak foot intrinsic muscles in fighters. However, the two main dysfunctions in the most recent three years have been capsular tightness of the hip, likely due to psoas muscle spasms or posterior abutment of the femur (Figure 6.4 and Table 6.4) and continued weak foot intrinsic muscle function (Table 6.5). When testing foot intrinsic function, UFC athletes continue to present with an excessive navicular drop. Excessive navicular drops have been determined to be a risk factor of knee pain/injury, plantar intrinsic muscle fatigue, ACL injuries, exercise-related lower leg pain, shin splints, ankle injuries and stress fractures to the fifth metatarsal. With all these apparent risk factors, preventative efforts to improve foot intrinsic muscle function is considered essential in UFC athletes.

TABLE 6.4
HIP CHARACTERISTICS

SCOUR TEST (HIP ARTHO-KINEMATIC IMPAIRMENT)		
	M	F
R	19%	24%
L	18%	21%

FABER (FIBULAR HEAD DISTANCE FROM SURFACE)			
	M	F	NORM
R (CM)	16	17	12.4
L (CM)	17	17	>3-4 ASYM

HIP RANGE OF MOTION					
	M		F		NORM
	R	L	R	L	
INTERNAL ROTATION (DEGREES)	37	36	46	45	45
EXTERNAL ROTATION (DEGREES)	66	61	59	58	45

TABLE 6.5
FOOT AND KNEE CHARACTERISTICS

NAVICULAR DROP		
	M	F
R (MM)	6	5
L (MM)	5	6

DORSIFLEXION RANGE OF MOTION		
	M	F
R (DEGREES)	41	42
L (DEGREES)	41	40

SPECIAL TESTS		
	M	F
LACHMAN	2%	8%
POSTERIOR DRAWER	4%	5%
VARUS (LCL) STRESS	5%	18%
VALGUS (MCL) STRESS	3%	8%







PART 1
SECTION 7

SECTION 7: DIETARY EVALUATION

By Taylor Wang and Alexa Eisenberg



- Understanding how a fighter is fueling him/herself is critical to assess in order to provide education and improve nutrition strategies.
- A complete dietary evaluation of a fighter should gather dietary history and gain insight into all phases of preparation (i.e., off-camp, fight-camp, and fight-week)
- The dietary evaluation should assess the fighter's goals and areas of concern; not just for diet but also other areas where nutrition interacts with training (e.g., recovery).
- When completing a dietary evaluation, we recommend using open-ended, non-leading questions that are as neutral as possible (i.e., non-biased)
- Be mindful that weight-class sports have a high occurrence of disordered eating. Acknowledge any differences between acute (e.g., purging) and chronic (e.g., under fueling) eating issues.

Dietary Evaluation Questionnaire

The following questionnaire provides an example of the important information needed to complete a comprehensive dietary evaluation.

NAME	
DOB	
HEIGHT	
WEIGHT CLASS	
CURRENT WEIGHT	
TYPICAL WALK AROUND WEIGHT	
FIGHT STATUS	
GOALS	
AREAS OF CONCERN/CURIOSITY RELATING TO NUTRITION	
DIETARY RECALL *(TYPICAL DAY)*	MON: TUE: WED: THUR: FRI: SAT: SUN:
PRE/POST FUELING STRATEGIES *(IF ANY)*	
WATER INTAKE	
FEMALES: MENSTRUAL CYCLE – LAST PERIOD, SYMPTOMS, IRREGULARITIES	
LAB VALUES *(if available)*	
HAVE YOU WORKED WITH A REGISTERED DIETITIAN/NUTRITIONIST BEFORE?	
TRAINING SCHEDULE – INTENSITY AND DURATION	
FIGHT WEEK FUELING, WATER AND WEIGHT CUT STRATEGIES	
REHYDRATION STRATEGIES	
TYPICAL FIGHT DAY FUELING STRATEGIES	
INJURY HISTORY	
SUPPLEMENTATION	
FOOD ALLERGIES/INTOLERANCES/ DISLIKES	
SLEEP QUALITY	
ENERGY LEVELS	
MOOD	
CRAVINGS	
OFF-CAMP vs. FIGHT-CAMP FUELING	
SIGNS OF CHRONIC DISORDERED EATING: binge eating episodes, negative body image talk, obsessive/compulsive behavior, preoccupation with weight/food, skipping meals, extreme mood swings, sleep problems, poor injury healing, etc	
MEDICATIONS: List any current medications	





PART 1
SECTION 8



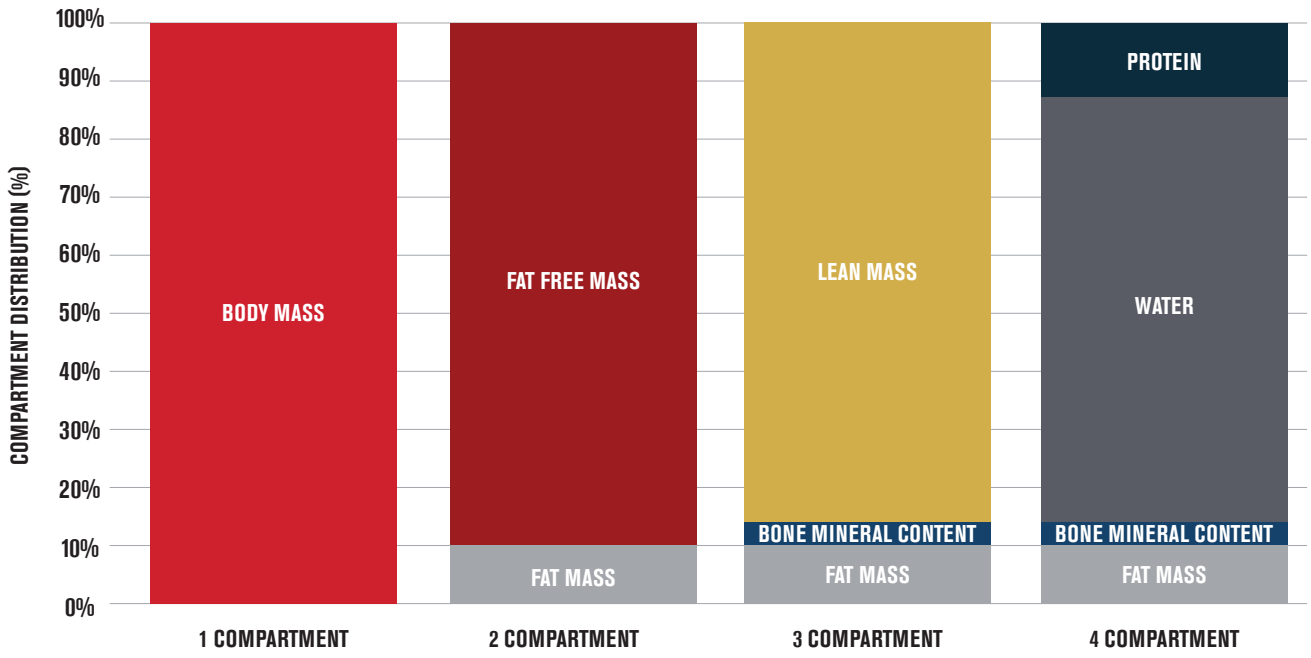
SECTION 8: BODY COMPOSITION AND ANTHROPOMETRY

By Reid Reale

Body composition and anthropometry refer to the measurement of the various compartments of the human body (e.g., body weight or height, bone density, muscle mass, limb length). Specific physical traits are known to be advantageous in some sports (e.g., height in basketball, muscle mass in American football, power-to-weight in gymnastics). Although the picture for MMA may be less clear than sports with a long history of scientific investigation, it is still possible to describe the physical makeup of an elite MMA fighter. Aside from painting the physical picture of what makes up a successful fighter, it is also important to understand how best to measure these anthropometric qualities, how to understand the benefits and limitations of different measurement techniques and how to standardize measurement procedures.

FIGURE 8.1

ONE, TWO, THREE AND FOUR-COMPARTMENT BODY COMPOSITION MODELS



BODY COMPOSITION VS BODY WEIGHT

Body weight refers to the number you see on the bathroom scale (e.g., kilograms, pounds). While this is crucially important when it comes to making weight for fighters, it doesn't tell the whole story. Instead, we can delve deeper by dividing the body into various compartments (see Figure 8.1) for more comprehensive analysis: i) a two-compartment model (fat mass and fat-free mass), ii) a three-compartment model (fat mass, bone mineral content, and lean mass) or even a four-compartment model (fat mass, bone mineral content, water content and protein content).

BODY COMPOSITION MEASUREMENT

Various methods exist to measure the different compartments, with each method having different pros and cons. In general, the more accurate a method, the more resource-intensive it likely is. For example, what might be considered the gold standard (i.e., cadaver dissection where you divide a corpse into its constituent parts) is impractical, even though it does provide a very accurate assessment. At the other end of the spectrum, simply standing on the bathroom scale is quick and easy, but it provides little information as to what the body is made up of. Therefore, other popular measurement methods routinely used include: i) girths and skinfolds (surface anthropometry), ii) bio-electrical impedance analysis (BIA) and iii) dual x-ray absorptiometry (DXA). There are, of course, other methods. However, a complete discussion on all of them is beyond the scope of this section. Table 8.1 provides an overview of many of the body composition assessment methods available.

TABLE 8.1
BODY COMPOSITION ASSESSMENT METHODS

METHOD	OUTCOME MEASURES	ADVANTAGES	DRAWBACKS
CADAVER DISSECTION	Skin, fat, bone, muscle, other	Very accurate, is used to validate other methods	Can only be done on deceased person, no normative data in athletes
MAGNETIC RESONANCE IMAGING (MRI)	Fat, bone, muscle, other	Very accurate, no exposure to ionizing radiation	Expensive technology, long analysis process
DUAL X-RAY ABSORPTIOMETRY (DXA)	Fat, bone, fat free soft mass	Cost and time efficient, small radiation dose, relatively good accuracy and precision, requires minimal subject involvement (lay still for 5-8 minutes)	Comparing between models/ manufacturers is problematic, regional legislation may limit repeat scanning frequency
UNDERWATER WEIGHING	Fat, fat free mass	Whole-body approach	Requires considerable subject involvement
AIR DISPLACEMENT PLETHYSMOGRAPHY (BODPOD)	Fat, fat free mass	Similar theoretical approach to body composition measurement as underwater weighing but simpler to conduct with less subject involvement	May be less valid in very lean or muscular subjects
BIOELECTRICAL IMPEDANCE ANALYSIS (BIA)	Total body Water, Fat, Fat-free mass	Ease of measurement, minimal subject involvement, reliable when standardization is ensured	Poor validity (especially in very lean or muscular individuals), results affected greatly by hydration status
SKINFOLD MEASUREMENT	Skinfold thickness, Results may be used in prediction equations to estimate body fat %	Cost effective, reliable and accurate measurement of skinfold thickness with trained technicians, can compare to normative data	Assess subcutaneous fat only, can be intrusive for some subjects, prediction equations routinely display poor validity, well-trained technicians are essential
BODY WEIGHT SCALE	Body weight	Quick and easy, valid and reliable as long as standardization is ensured	Provides no direct information on body composition

At the UFC PI, we routinely use three individual methods to track body composition and weight: DXA, BIA and body-weight scales. DXA is considered the most valid and is crucial in helping us support decisions around the best weight division for a fighter (see Section 12). BIA, while not as valid as DXA, is reliable and suitable to repeat on a regular basis to track acute changes. Finally, simple body-weight measurements provide valuable information as to how an athlete is responding to nutrition/training interventions, and when used in combination with other data, (e.g., DXA measures, strength measures in the gym, subjective measures of training progress, etc.) it can often provide very accurate evaluations of progress.

With all the respective measures of body composition, standardizing the measurement process is paramount in order to get the most useful information possible. This means controlling as many of the variables that can affect readings as possible—and those which are not controlled need to be identified and understood (see Table 8.2). An example of this is wearing clothing when measuring body weight. Ideally the athlete should be nude in order to get the most accurate measurement. However, if instead of weighing nude, the athlete weighs themselves wearing the same clothes each time (e.g., rash guard and spandex underwear), this represents standardizing the measurement process. If an athlete weighs themselves wearing different clothes, but we know what the different clothes weigh, we could say that we have not standardized the measurement process but we understand the variables (i.e., different clothing) affecting the measurement.

TABLE 8.2

VARIABLES WHICH CAN AFFECT BODY WEIGHT/ BODY COMPOSITION MEASUREMENTS

VARIABLE	EFFECT ON BODY WEIGHT / BODY COMPOSITION MEASUREMENT	COMMENTS ON STANDARDIZATION
CLOTHING	Increase	Nude measurements or wearing the same clothes
SWEAT LOSS	Decrease (if not replaced post training)	Measurements should be taken in the morning prior to training (unless goal is to measure sweat lost during training)
SWEAT SOAKED CLOTHING OR SWEAT ON BODY	Increase (if not toweled off)	Nude measurements Towel off sweat
STORED CARBOHYDRATE (GLYCOGEN)	Glycogen is stored carbohydrate and binds to water at a ratio of about 1:3. So, when carbohydrate stores are full, body weight may be 2 to 4% higher	Glycogen stores will be higher after rest day(s) and following increased carbohydrate intake. This means generally weight will be higher at the beginning of the week.
FOOD AND FLUID INTAKE	Food and fluid throughout the day will increase weight. Increases/decreases in food volume and fiber intake will increase/decrease gut content and body weight, which may show up as lean mass in body composition measurement	Fasted measurements preferred Understanding fluid, food volume & fiber intake over the past 24-72 hours will assist with understanding body weight changes
BLADDER OR BOWEL MOVEMENT	Weight will decrease following passing solids or fluids	Take measurements following voiding of bowels and bladder



ASSESSING BODY COMPOSITION

We recommend that fighters perform a DXA scan assessment at least once per year in order to help assess weight division fit and to get an accurate assessment of their body composition. This DXA scan should ideally be done in off-camp or at the beginning of fight-camp when body fat reduction is not being aggressively pursued and the athlete has followed several days of a "normal" diet. DXA scans should be performed in the morning, prior to eating or drinking (even water) and before any physical exertion. Athletes should be well hydrated from the day before and have gone to the toilet and passed any solids and fluids. The morning of the DXA, athletes should also weigh themselves nude on body-weight scales. Following the DXA, an athlete will then have a good idea of how much bone mass, fat mass and muscle mass they have. This information will be vital in assessing weight division fit. Athletes will also have a body-weight measure which corresponds to this body composition. If another DXA scan is not performed for many months, routine body weight measures can provide good information that can be related back to body composition measures.

HOW TO WEIGH YOURSELF

When assessing body fat or muscle mass changes and how close an athlete is to his or her weight division, the only weight of interest is the morning, fasted and rested bodyweight. Weighing yourself at random times throughout the day is quite problematic due to the effect of food, fluid, training, sweat and other factors. So, it is important athletes weigh themselves first thing in



the morning, after going to the bathroom and before eating. Due to day-to-day fluctuations in gut content and hydration status, weight can fluctuate regardless of standardization. This means getting multiple measures will provide a better picture of "true" weight. We also recommend taking a weight at the beginning of the week and at the end of the week (at least in some weeks) to get an idea of how fluctuations in stored carbohydrates will affect weight. An example strategy may include collecting a weight in the morning on Mondays and Tuesdays (the average of this will indicate the "heaviest" standardized weight) and then on Fridays and Saturdays (the average of this will indicate the "lightest," or lowest glycogen status weight) if a fighter normally trains Monday to Saturday with Sunday off. It is important to note that constantly recording weights can take its toll mentally, and certainly athletes in weight-category sports are at increased risk of body image and eating disorders, so this needs to be balanced. A negotiated protocol may involve weighing once or twice a month in off-camp, every second week on Mondays and Tuesdays in the early stages of fight-camp and Mondays/Tuesdays/Fridays/Saturdays in the latter stages of fight-camp.

BODY COMPOSITION, ANTHROPOMETRY AND PERFORMANCE

In a weight-class sport like MMA, the management of weight and body composition plays a fundamental role in performance. Furthermore, anthropometry and physical stature influence the ability to manage reach and range and to potentially dictate fight characteristics, particularly during stand-up striking.



BODY COMPOSITION AND PERFORMANCE

We know that muscle mass is correlated with strength and power, and as body fat can be reduced to lower body weight, we are able to improve a fighter's power-to-weight ratio by maximizing muscle mass while minimizing body fat at a given body weight. On the other hand, there is evidence to suggest that heavier athletes may have an advantage in many combat sports, hence the reason why athletes attempt to cut (primarily water) weight prior to weigh-in and then regain weight after weigh-in. The issue is that cutting too much weight has the potential to affect a fighter's health and performance, and in some extreme cases, can be dangerous. Furthermore, there is little evidence to indicate that the more weight you cut the better the competitive outcome. Therefore, it makes sense to cut and regain "enough" weight to be in the range of what others are doing so as not to give up an advantage to your opponent, while not cutting such great amounts that affect health and performance. Combining this together, and drawing on published research in other combat sports, as well as data collected at the UFC PI, we can recommend i) body fat percentage ranges for various phases of preparation (see Table 8.3) and ii) recommended body weight ranges off-camp and throughout a fight-camp for respective weight classes (see Table 8.4).

TABLE 8.3

BODY FAT PERCENTAGE AT DIFFERENT POINTS RELATIVE TO OFFICIAL WEIGH-IN IN UFC FIGHTERS

	START OF FIGHT-CAMP	MID FIGHT-CAMP	AT WEIGH-IN/FIGHT	OFF-CAMP/ OFF SEASON
MALE	9-16%	7-14%	5-12%	<18%
FEMALE	16 – 26%	14 -24%	12-22%	<28%

Note: In general, lighter athletes are typically more able to achieve lower levels of body fat than heavier athletes

TABLE 8.4

BODY WEIGHT RECOMMENDATIONS BY TRAINING PHASE FOR EACH WEIGHT CLASS

WEIGHT DIVISION	WEIGH-IN	2 WEEKS PRIOR TO WEIGH-IN 8% - 10%		6 WEEKS PRIOR TO WEIGH-IN, LESS THAN (12%)	ALWAYS BELOW (16%)
STRAWWEIGHT	115	124.4	126.5	128.8	133.4
FLYWEIGHT	125	135.0	137.5	140.0	145
BANTAMWEIGHT	135	145.8	148.5	151.2	156.6
FEATHERWEIGHT	145	156.6	159.5	162.4	168.2
LIGHTWEIGHT	155	167.4	170.5	173.6	179.8
WELTERWEIGHT	170	183.6	187.0	190.4	197.2
MIDDLEWEIGHT	185	199.8	203.5	207.2	214.6
LIGHTHEAVY WEIGHT	205	221.4	225.5	229.6	237.8
HEAVYWEIGHT	265	286.2	291.5	296.8	307.4

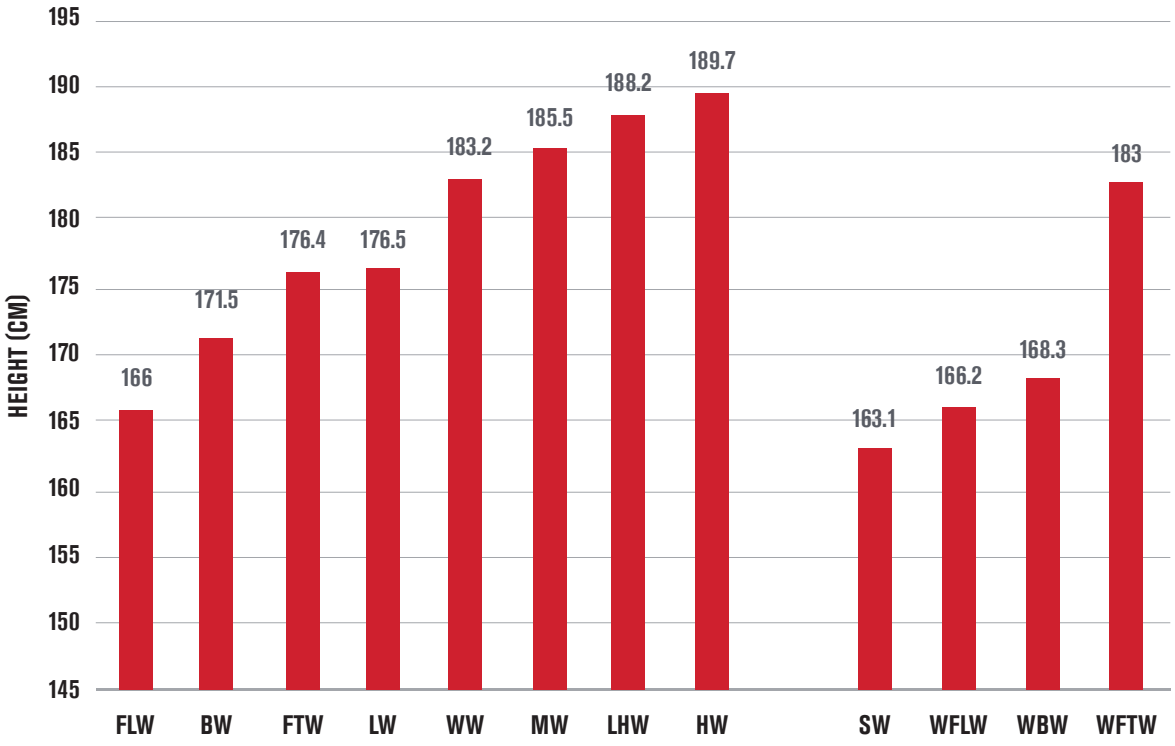
Note: This table serves as a guide only and is designed as a suitable body mass management plan which will allow athletes to avoid the need to endure long periods of low energy intake or severe weight cuts. Often, many successful athletes may engage in body mass management practices different to those suggested here.

It should be noted that every athlete is different due to their genetic makeup. Because of these inherent genetic factors, along with lifestyle, social and cultural factors, not every athlete will be able to achieve specific body-composition goals, particularly when it comes to low levels of body fat. Further, even when athletes are able to achieve increasingly levels of leanness, very low body fat levels are not conducive to good health. Indeed, professional medical and sports science bodies recommend 5 percent (men) and 12 percent (women) as the lowest level of body fat which may be conducive to good health.


STAFF
UFC
Reebok
DEVA

FIGURE 8.2

AVERAGE HEIGHT BY WEIGHT CLASS IN UFC FIGHTERS



ANTHROPOMETRY AND PERFORMANCE

Height and limb length play a fundamental role in influencing a fighter's strategy and technique. For example, fighters with a long reach or long legs have the ability to manage the distance between themselves and an opponent more effectively and potentially deliver scoring impacts while remaining outside of the "danger zone" presented by an opponent's shorter reach and striking range. Figure 8.2 shows average height by weight class for UFC fighters.

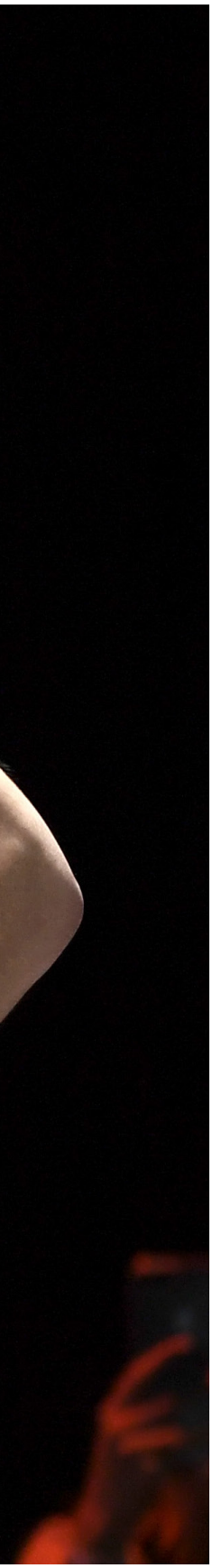
Coming to definitive decisions about certain aspects of MMA is often difficult: For example, determining how an athlete should optimize his or her body composition, choose the most appropriate weight division or how to marry this with a successful fight strategy and game plan. However, using the information presented in the section, as well as that in the rest of this Journal, can help athletes and coaches make evidenced-based and informed decisions which will better protect athlete health and optimize performance.





PART 1
SECTION 9


UFC
HRSD
HONOR / RESPECT
STRENGTH / DISCIPLINE
Reebok



SECTION 9: NUTRITION DIAGNOSTICS: METABOLISM

By Reid Reale

Broadly speaking, metabolism refers to all the chemical reactions that take place within the human body. More specifically, and relevant to athletes and support staff, are measures of resting metabolic rate and exercise metabolism. Both of these assessments focus on the measurement of the oxygen (O_2) consumed and the carbon dioxide (CO_2) produced by the body either at rest or during various exercise tests. These measurements can provide valuable information regarding the amount of energy that an athlete uses (measured in kilojoules or kilocalories) and the specific ratio of carbohydrate to fat used to produce that energy (indicated by the respiratory quotient (RQ)). This information is useful as it assists dietitians in carrying out appropriate nutrition programming but also in assessing the overall metabolic health and functioning of an athlete.

CUNNINGHAM EQUATION

500 + (FAT-FREE MASS IN KG X 22) = RMR (KILOCALORIES)

SCHOFIELD EQUATION

693 + (15 X WEIGHT IN KG) = RMR (KILOCALORIES)

RESTING METABOLIC RATE

Resting metabolic rate (RMR) refers to the energy used by the body at rest to perform its basic functions. RMR can be indirectly predicted through various equations or measured more directly. Many prediction equations exist for the calculation of RMR, and all use various combinations of independent variables such as age, sex, height, weight, lean mass, fat mass and others to calculate a predicted RMR. Two popular equations are the Cunningham equation, which uses fat-free mass as the main predictor (commonly suggested for athletes) and the Schofield equation which uses height and weight (useful for instances when one does not have body composition measures).

RMR is largely determined by lean mass but varies between individuals and can be influenced by a variety of factors including stress, nutrition and training. For example, overtraining and/or insufficient energy/caloric intake to support the demands of training and recovery can result in decreased RMR. Therefore, routinely measuring an athlete's RMR and comparing it against one's predicted RMR can provide indications to whether or not an athlete is adequately supporting the physical demands of his or her training with nutrition or if they are maladapting to the prescribed training loads. Training itself is designed to stress the body, so some reduction in RMR is to be expected. But, when these reductions are severe and persist despite planned recovery blocks in the training program, the risk of injury and illness increases, and the bodies ability to adapt to training is compromised.

FIGURE 9.1

RMR MEASURES THROUGHOUT FIGHT-CAMP FOR AN ATHLETE WHO TOLERATED TRAINING LOAD WITH MINIMAL DISTURBANCE

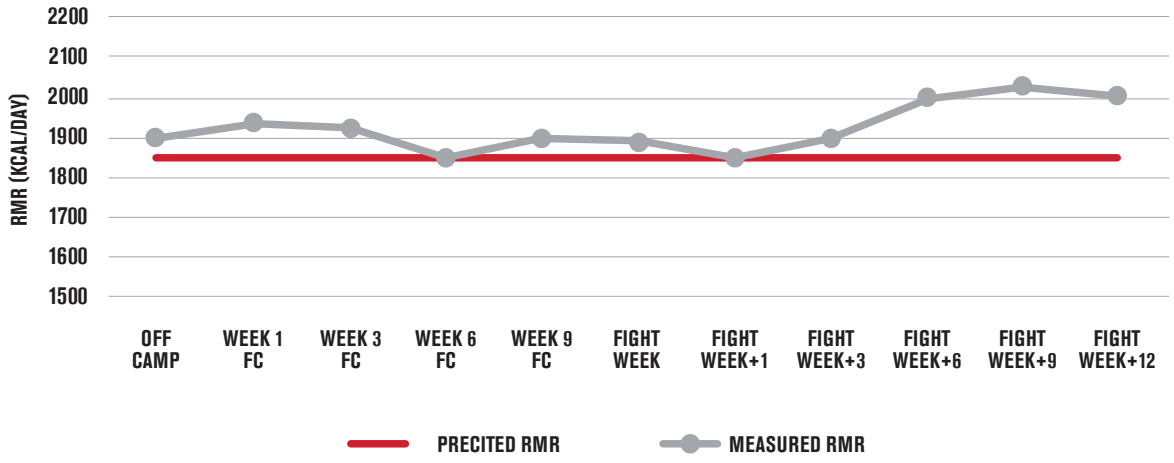


FIGURE 9.2

RMR MEASURES THROUGHOUT FIGHT-CAMP FOR AN ATHLETE WHO WAS SIGNIFICANTLY COMPROMISED BY THE REQUIRED TRAINING LOAD, PRESENTING WITH SUPRESSED RMR

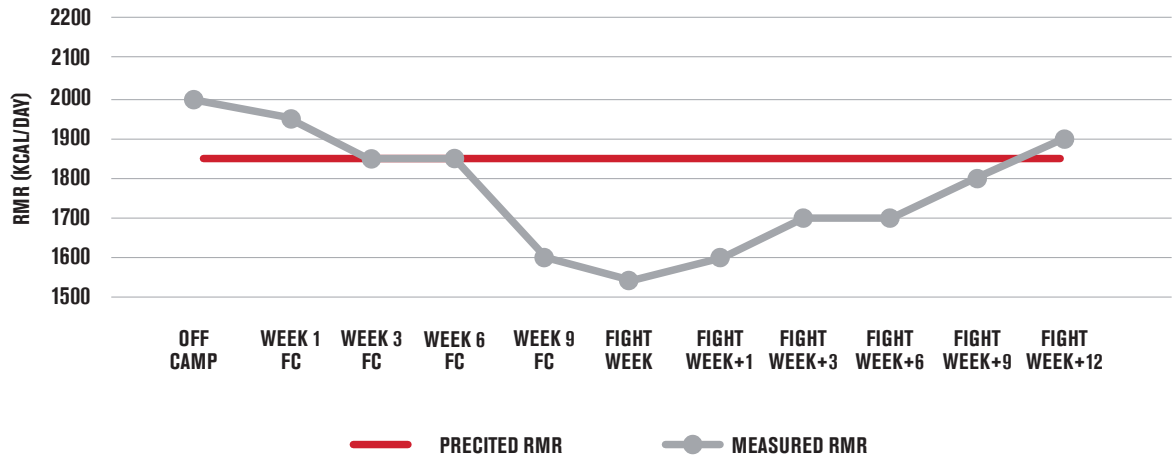
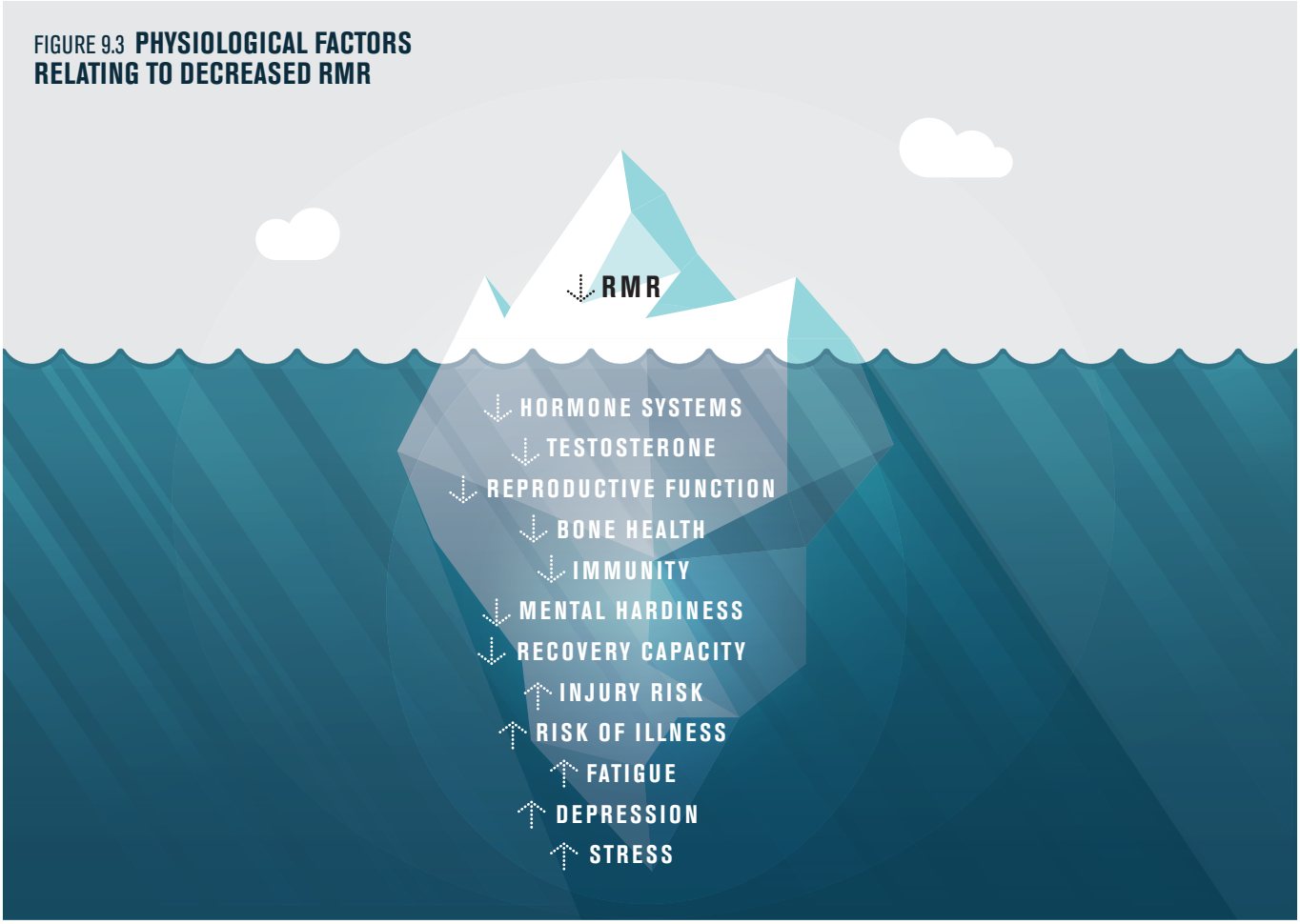


Figure 9.1 shows the RMR of a fighter throughout fight-camp with minimal disturbance. In comparison, Figure 9.2 shows the RMR for a different fighter who struggled to tolerate the demands of the training load and presented with an RMR significantly suppressed throughout the fight-camp.

Note: In Figure 9.1, RMR does drop in Week 6 when training is increased, but the athlete recovers by Week 9 as sufficient rest and nutrition were introduced. RMR then decreases slightly again during fight-week (likely because of weight cutting) but recovers quickly in the weeks following the fight. In Figure 9.2, RMR dramatically decreases throughout fight-camp (likely due to overtraining and/or insufficient energy intake) and takes a significant amount of time to normalize post-fight. When an RMR is measured and it is significantly lower than predicted, or if there is a decreasing trend over time, this can be thought of as the "tip of the iceberg," in that objective measurement allows us to see these changes, but lurking beneath the surface of the athlete's physiology can be a collection of compromised body systems and risk factors (Figure 9.3).

FIGURE 9.3 **PHYSIOLOGICAL FACTORS RELATING TO DECREASED RMR**



HOW TO MITIGATE RMR SUPPRESSION

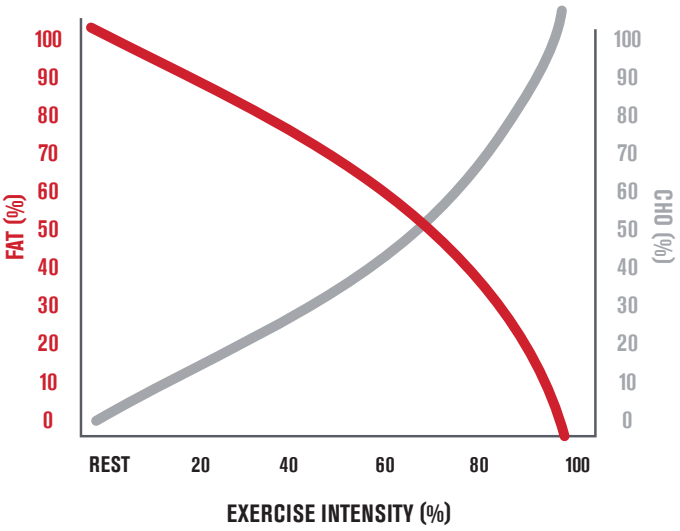
A suppressed RMR is indicative of a condition commonly referred to as relative energy deficiency in sport (RED-s). RED-s is thought to be largely driven by low energy availability (LEA) (i.e. when one does not consume enough energy to support basic and exercise needs). Therefore, in order to reduce the risk of RED-s, an athlete needs to reduce the presence of LEA. This can be done through a number of methods, including a reduction in total training load or increasing dietary energy/caloric intake. Of course, fighters often need to intentionally decrease energy intake to facilitate body fat loss as a means to support them making weight, but in general, avoiding prolonged periods of decreased energy intake is advised. Indeed, matching energy intake to energy expenditure, "bookending" workouts with pre- and post-nutrition and ensuring regular meal frequency are all strategies to achieve this goal. See Sections 67 and 68 (Fight Camp Fuelling Strategies & Managing Weight Descent) to better understand how to best implement nutrition interventions that support training. In addition to adequate fuelling, managing body weight sensibly over the long term and selecting the right weight division will also support the goal of preventing LEA and the potential onset of RED-s (see Sections 8, 12 and 35 on Body Composition, Weight Division Fit & Weight Descent Preparation).

SUBSTRATE USE AND RESPIRATORY QUOTIENT

Although there can be times when energy is produced from the breakdown of proteins, ketones (e.g. in states of prolonged fasting or starvation) and even alcohol, this only occurs in specific and exceptional circumstances. The vast majority of the time, our body derives energy from the breakdown of carbohydrate and fats. At rest and at low intensities of exercise, we rely more on fats than carbohydrate. However, during exercise as intensity increases, there becomes a greater reliance on carbohydrate to provide energy. This is largely due to the fact that fat oxidation is a slow process and cannot provide large amounts of energy during intense exercise efforts, whereas the breakdown of carbohydrate for energy is a fast-acting process able to fuel intense efforts. Figure 9.4 provides a representation of the crossover in fuel utilization between fat and carbohydrate as exercise intensity increases. From this figure, it is possible to see that fat oxidation predominated at rest and at very low intensities, but around 70% of maximal effort carbohydrate becomes the predominate source of energy to sustain exercise at the desired intensity.

FIGURE 9.4

REPRESENTATION OF SUBSTRATE UTILIZATION WITH INCREMENTAL EXERCISE INTENSITY



Putting this in context for fighters, during hard sparring sessions, intense wrestling practices and definitely during a fight, the body works almost entirely off of carbohydrates, whereas when during low-intensity sessions (perhaps when lightly drilling technique, completing low-intensity cardio or working on strategy) fewer carbohydrates are required, and more fat can be utilized. When we consider the fight itself, MMA is comprised of six to 36 seconds of high-intensity efforts, followed by two-to-three times as much low-intensity effort, and this is cycled throughout five-minute rounds. Consequently, the body will rely on carbohydrate during those high-intensity efforts and then relatively more fats during the recovery or lower intensity periods.

When measuring exercise metabolism and RMR we can simultaneously assess the utilisation of these various substrates. The respiratory quotient (RQ) is a number that represents the ratio of oxygen consumed to carbon dioxide produced during breathing and indicates the particular ratio of fats and carbohydrates used to fuel the activity being measured (e.g. rest, low-intensity exercise). When energy is derived exclusively from fat, RQ is 0.7. This number increases as the reliance on carbohydrate increases. At rest, an RQ ranging from 0.76-0.85 seems to represent normal metabolic state and is neither overly reliant on carbohydrate or fat. When metabolism is entirely fuelled by carbohydrate, RQ is 1.0 (see Figure 9.5).

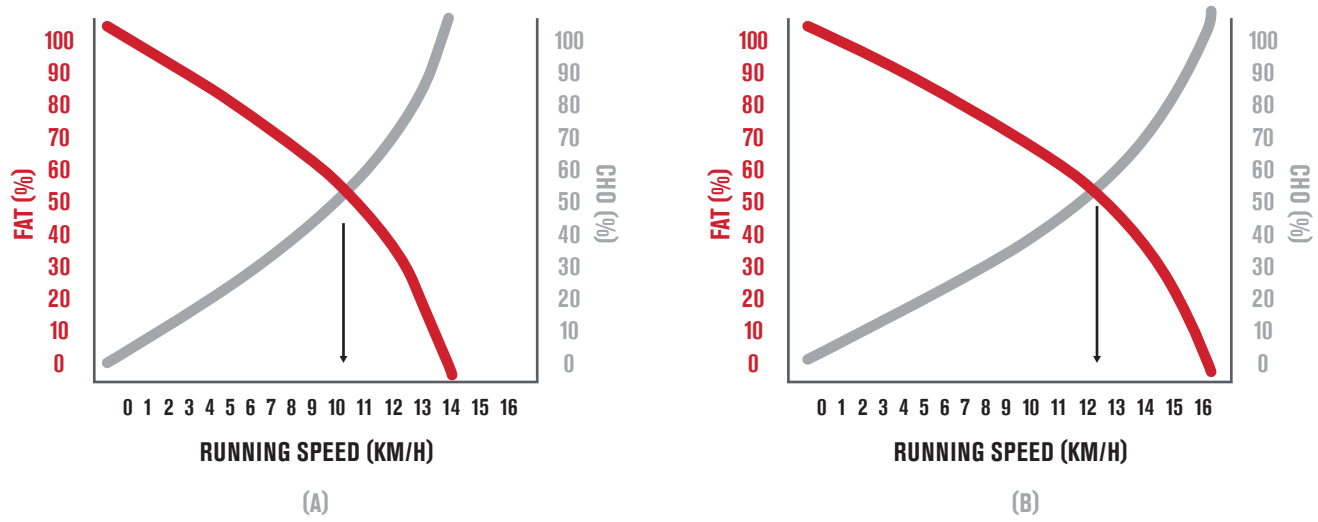
FIGURE 9.5

RESPIRATORY QUOTIENT PROFILE AT REST | RESPIRATORY QUOTIENT (RQ) REPORT ANALYSIS

0.71 0.72 0.73 0.74 0.75 0.76	0.77 0.78 0.79 0.80	0.81 0.82 0.83 0.84	0.85 0.86 0.87 0.88 0.89 0.90	0.91 0.92 0.93 0.94 0.95 0.96 0.97 0.98 0.99 1.00
Excessively fat dependent indicating loss of alactic energy system and malnutrition—**NOT RECOMMENED FOR UFC ATHLETES**	FAT SUBSTRATE ADAPTED—ideal for aggressive weight management and/or oxidative system development	FAT OPTIMIZED substrate adaptation—ideal for fight ready adaptations	Carbohydrate substrate adaptation—ideal for general prep. & metabolic rehab. phases	Carbohydrate substrate dependent indicating loss of oxidative energy system and reliance on exogenous carbs for all energy demands—**NOT RECOMMENED FOR UFC ATHLETES**

FIGURE 9.6

SUBSTRATE UTILIZATION RESPONSES BEFORE (A) AND AFTER (B) A SUSTAINED BLOCK OF TRAINING



During exercise, RQ increases as relative intensity increases. However, one adaptation that occurs with chronic exercise training is that RQ, and a reliance on carbohydrate, can decrease over time. Figure 9.6 illustrates substrate utilisation before and after a block of training where improvements in cardiorespiratory fitness, increased amounts of energy derived from fat at lower intensities, and the preservation of carbohydrate for higher intensity efforts are apparent. Figure 9.6A shows the crossover in fuel utilization from fat to carbohydrate as the main fuel source occurs at 10.5km/h. Following training (Figure 9.6 B) this crossover does not occur until 12km/h, demonstrating the preservation of carbohydrates for critical high-intensity efforts.

In addition to physical training, a host of nutritional interventions can also impact RQ. Conversely, the RQ of a particular activity can influence the most appropriate feeding strategy. Some key points to consider include:

1. Energy system adaptations elicited by physical training should be supported nutritionally to attain peak performance.

The training undertaken to prepare for a fight includes technical training (e.g. drilling, sparring) and strength and conditioning activities (e.g. resistance training, energy systems development). To optimize training, energy substrates are required that support a targeted energy system. For example, activities that stress the alactic and glycolytic systems (i.e. five-second to three-minute intervals) rely primarily on energy delivered from carbohydrate sources to complete the work. Therefore, if carbohydrate availability is low when training these systems, it is likely that a lack of substrate availability will limit this type of training, as well as the adaptations to these training stimuli.

2. Stimulating fat oxidation may help support energy stability and body composition.

Purposefully training with low-carbohydrate availability drives the utilization of alternative fuel sources. At high intensities, this can be problematic, but at moderate to low intensities, the absence of carbohydrate can drive up fat oxidative capacity, particularly from adipose tissue stores. This fat oxidation drives the body to be more reliant upon fat than carbohydrates at rest and low to moderate intensities.

Fueling with dietary fat pre-training can provide exogenous fat that can then be used for energy during exercise, stimulating the body to preferentially use fat substrate at moderate and low exercise intensities. The increase in dietary fat consumption also provides an alternative to carbohydrate energy and helps mitigate overall energy deficits. Healthy sources of dietary fat that can be included in this fat-fueling strategy include fish, nuts and seeds, minimally processed oils, full-fat dairy and eggs.



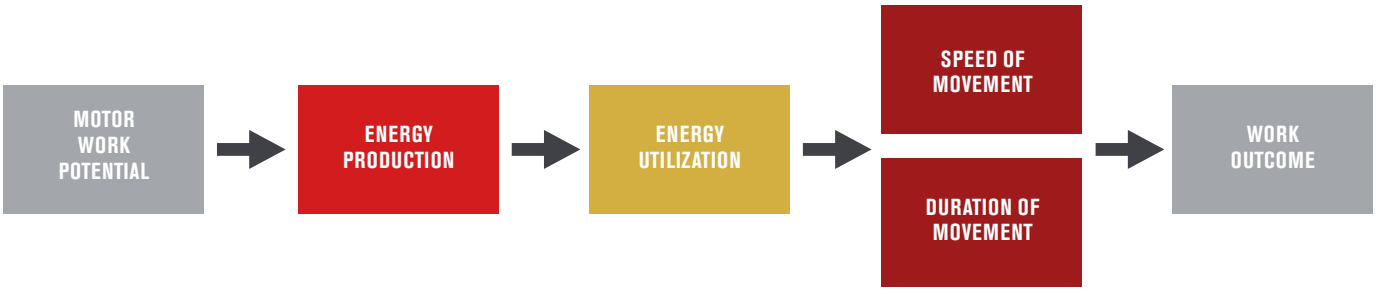


PART 1
SECTION 10

SECTION 10: ENERGY SYSTEMS & BIOENERGETICS

By Duncan French

FIGURE 10.1
THE BIOENERGETIC BASIS OF PHYSICAL PERFORMANCE



The physical demands of MMA make it amongst the most complex of all sports, with fighters requiring high levels of metabolic capacity alongside explosive knockout power and the strength to takedown and manipulate an opponent. MMA can be loosely defined as *"a high-intensity intermittent sport in which force must be repeatedly exerted against an external resistance in the form of an opponent."* The bioenergetic demands of MMA require the manipulation of alactic, lactic and aerobic energy systems in a highly complex fashion. Indeed, while championship bouts are 25 minutes in duration (five 5-minute rounds), each round is made up of high-intensity epochs of activity lasting six to 36 seconds, interspersed with periods of lower-intensity activity lasting two to three times as long. This complex physiology makes MMA somewhat of a combat "marathon" (i.e., 25 minutes long), but notably knockouts and TKOs occur in these high-intensity epochs of activity, making these explosive efforts critical to success.

Energy Systems Development (ESD), or the bioenergetics of exercise, represent a critical component of physical preparation for MMA. If a fighter's energy system is inappropriately prepared, there can be a significant bearing on the outcome of fights. Indeed, few fighters lose because they weren't strong enough, but there are many instances where fighters have lost because their metabolic conditioning was insufficient to match the work rate of their opponent.

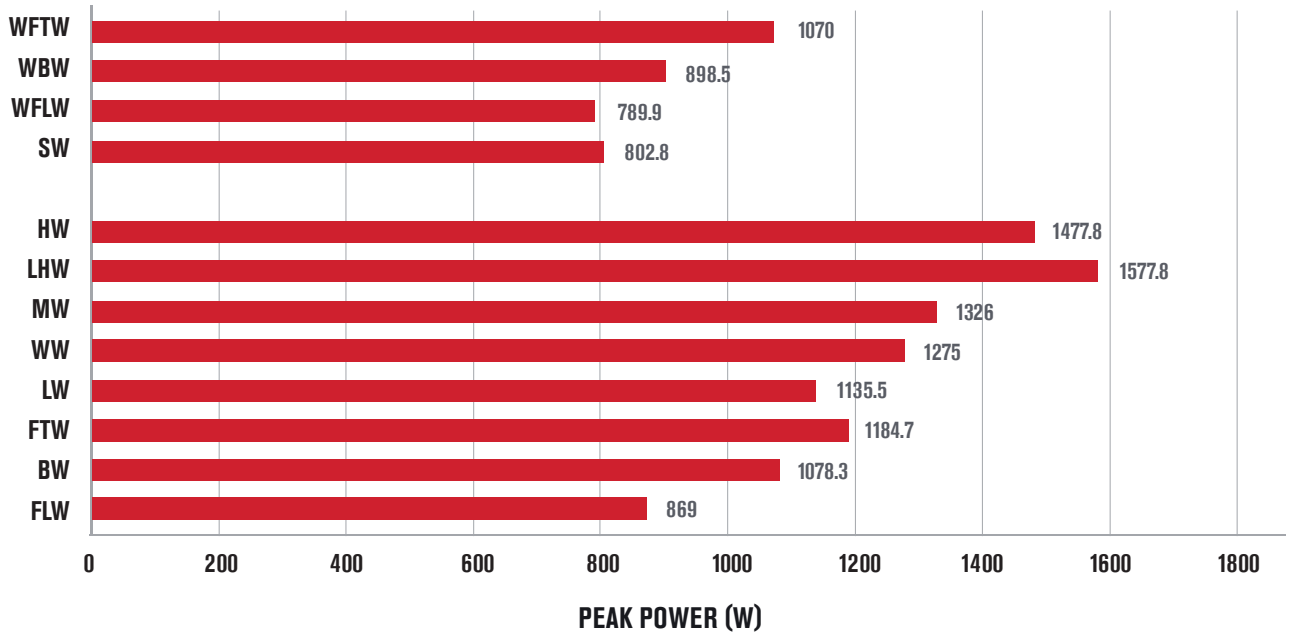
As a definition, conditioning is simply: *"The ability of an athlete to meet the energy production demands of their sport."* It would be wrong to think that the aim of physical preparation is only the development of muscular strength and power. Indeed, the strength capacities of skeletal muscle which are used to clinch with an opponent or to force a takedown are themselves secured by the energy produced through corresponding bioenergetic processes. Fundamentally, the role of supplementary strength and conditioning (i.e., non-technical training) is to develop the physical preparedness, or work potential, necessary for an athlete to effectively utilize his or her technical skills i) as fast possible and ii) for as long as possible. From an energy systems perspective, the overarching goal is therefore to produce more energy, at a faster rate, for a longer duration. Figure 10.1 shows how energy production (i.e., capacity) and energy utilization (i.e., rate) have a central role to play in determining critical factors that determine success in MMA (e.g., if you can move faster than an opponent or perform techniques for longer you will have a competitive advantage).

Importantly, all ESD strategies should be aligned to the specific bioenergetic needs of MMA. This includes i) a well-developed alactic system that can provide high rates of energy production in very short time frames in order to throw knockout punches or sprawl to defend against takedowns, ii) a lactic system with a large capacity that can produce energy during sustained high-intensity efforts such as pummelling and clinch work against the fence or flurries of punches and elbows during ground-and-pound and finally iii) a large aerobic system with the capacity and efficiency to resynthesize the energy utilized through anaerobic pathways (i.e., i and ii above), and to sustain moderate levels of activity for longer periods of time (i.e., any exercises longer than three minutes is predominantly aerobic in nature, and MMA rounds last five minutes).



FIGURE 10.2

PEAK POWER OUTPUT (W) DURING A 10-SECOND WATTBIKE MAP TEST



ALACTIC CHARACTERISTICS

Maximal Alactic Power (MAP) is a representation of the rate at which energy can be produced during short, very high-intensity efforts (e.g., throwing power punches like a hook or uppercut). Figure 10.2 shows the peak power (Ppeak) output by weight class achieved by UFC fighters during a 10-second Wattbike maximal sprint (against a resistance of 0.09*body weight). Table 10.1 presents UFC performance benchmarks for Ppeak by weight class for comparative purposes.

In addition to understanding the Ppeak produced during a single one-off alactic effort, it is important to also understand the capacity to repeatedly produce near-maximal power outputs. This is because, and as mentioned above, the ability to repeatedly generate Ppeak over-and-over during short flurries of effort is considered a determinant of performance in MMA (e.g., throwing combination punches). Figure 10.3 show weight class averages for UFC fighters performing 10 six-second maximal sprints on the Wattbike against a resistance load of 0.09*bodyweight with Table 10.2 showing the respective performance benchmarks.

TABLE 10.1

PEAK POWER PERFORMANCE BENCHMARKS BY WEIGHT CLASS FOR A 10-SECOND WATTBIKE MAP TEST

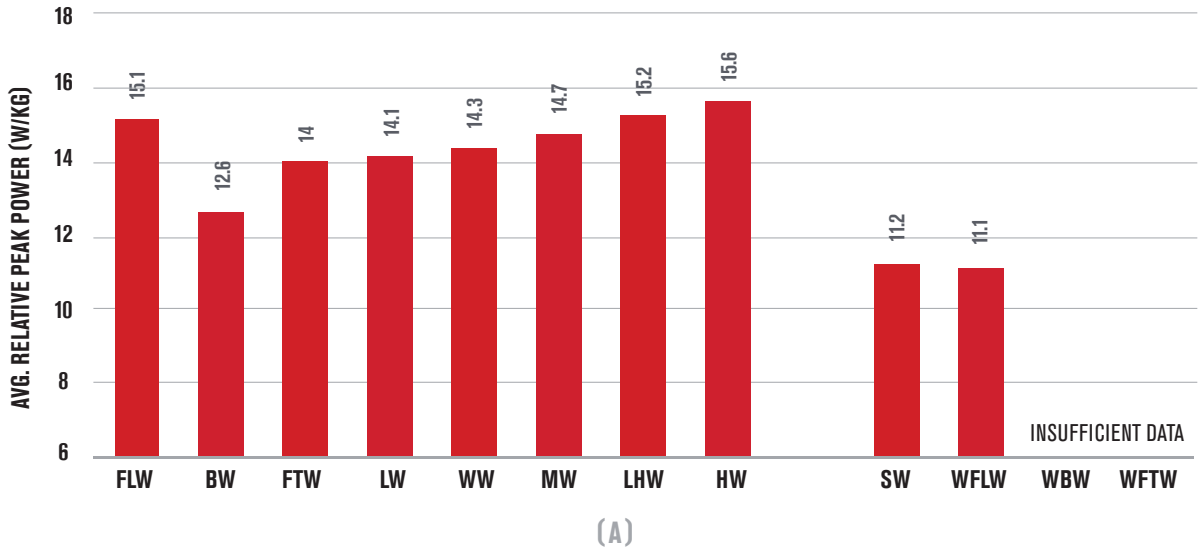
FLW		BW		FTW		LW	
WORLD CLASS	> 1004	WORLD CLASS	> 1198	WORLD CLASS	> 1344	WORLD CLASS	> 1287
VERY GOOD	950 - 1003	VERY GOOD	1150 -1197	VERY GOOD	1281 - 1343	VERY GOOD	1227 - 1286
GOOD	910 - 949	GOOD	1115 -1149	GOOD	1233 - 1280	GOOD	1182 - 1226
FAIR	830 - 909	FAIR	1043 -1114	FAIR	1139 - 1232	FAIR	1092 - 1181
POOR	790 - 829	POOR	1008 -1043	POOR	1091 - 1138	POOR	1047 - 1091
VERY POOR	736 - 789	VERY POOR	960 - 1007	VERY POOR	1028 - 1090	VERY POOR	987 - 1046
BAD	< 735	BAD	< 959	BAD	< 1027	BAD	< 986

WW		MW		LHW		HW	
WORLD CLASS	> 1433	WORLD CLASS	> 1520	WORLD CLASS	> 1750	WORLD CLASS	> 1717
VERY GOOD	1370 - 1432	VERY GOOD	1143 - 1519	VERY GOOD	1682 - 1749	VERY GOOD	1622 - 1716
GOOD	1323 - 1369	GOOD	1385 - 1442	GOOD	1630 - 1681	GOOD	1550 - 1621
FAIR	1229 - 1322	FAIR	1269 - 1384	FAIR	1528 - 1629	FAIR	1408 - 1549
POOR	1182 - 1228	POOR	1211 - 1268	POOR	1476 - 1527	POOR	1336 - 1407
VERY POOR	1119 - 1181	VERY POOR	1134 - 1210	VERY POOR	1408 - 1475	VERY POOR	1241 - 1335
BAD	< 1118	BAD	< 1133	BAD	< 1407	BAD	< 1240

WSW		WFLW		WBW		WFTW	
WORLD CLASS	> 877	WORLD CLASS	> 834	WORLD CLASS	> 912	WORLD CLASS	> 1083
VERY GOOD	848 - 876	VERY GOOD	817 - 833	VERY GOOD	907 - 911	VERY GOOD	1078 - 1082
GOOD	826 - 847	GOOD	804 - 816	GOOD	904 - 906	GOOD	1075 - 1077
FAIR	782 - 825	FAIR	778 - 803	FAIR	896 - 903	FAIR	1067 - 1074
POOR	760 - 781	POOR	765 - 777	POOR	893 - 895	POOR	1064 - 1066
VERY POOR	731 - 759	VERY POOR	748 - 764	VERY POOR	888 - 892	VERY POOR	1059 - 1063
BAD	< 730	BAD	< 747	BAD	< 887	BAD	< 1058

FIGURE 10.3

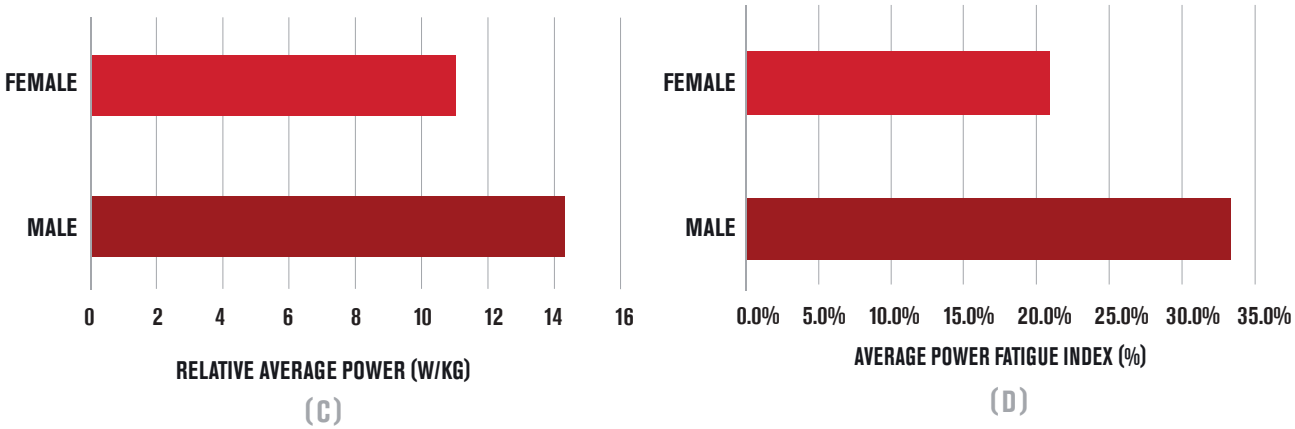
AVERAGE RELATIVE PEAK POWER OUTPUT (W/KG) (A, C) AND ASSOCIATED REDUCTION IN REPEAT SPRINT PERFORMANCE (I.E., FATIGUE INDEX) (B, D) DURING 10 X 6-SECOND WATTBIKE MAP TEST



(A)



(B)



(C) (D)

*Insufficient data available for WBW and WFTW.



TABLE 10.2

RELATIVE AVERAGE POWER (A) AND POWER FATIGUE INDEX (B) PERFORMANCEBENCHMARKS FOR MALES AND FEMALE FIGHTERS IN THE 10 X 6-SECOND WATTBIKE MAP TEST

MALE		FEMALE	
WORLD CLASS	> 16.7	WORLD CLASS	> 12.6
VERY GOOD	15.8 - 16.6	VERY GOOD	12.0 - 12.5
GOOD	15.1 - 15.7	GOOD	11.6 - 11.9
FAIR	13.7 - 15.0	FAIR	10.7 - 11.5
POOR	13.0 - 13.6	POOR	10.2 - 10.6
VERY POOR	12.1 - 12.9	VERY POOR	9.6 - 10.1
BAD	< 12.0	BAD	< 9.5

(A)

MALE		FEMALE	
WORLD CLASS	> 42.5	WORLD CLASS	> 28.4
VERY GOOD	38.9 - 42.4	VERY GOOD	25.4 - 28.3
GOOD	36.1 - 38.8	GOOD	23.2 - 25.3
FAIR	30.7 - 36.0	FAIR	18.8 - 23.1
POOR	27.9 - 30.6	POOR	16.6 - 18.7
VERY POOR	24.3 - 27.8	VERY POOR	13.6 - 16.5
BAD	< 24.2	BAD	< 13.5

(B)

LACTIC CHARACTERISTICS

Lactic capacity, or glycolytic power (MGP), is a critical component of MMA and has been shown to differentiate between higher and lower ranked fighters. MGP represents the magnitude to which the body can continue to produce energy in the absence of oxygen at high intensities for prolonged periods of time (e.g., sustained grappling efforts and fence wrestling). Figure 10.4 shows the average power achieved by weight class during a three-minute MGP test on the Wattbike (against a resistance of 0.6*resistance from the 10 x 6-second alactic repeat test). Figure 10.5 shows the relative average power output by weight class. Table 10.3 presents UFC performance benchmarks for average power output.

FIGURE 10.4

AVERAGE POWER OUTPUT (W) DURING 3-MINUTE WATTBIKE MGP TEST

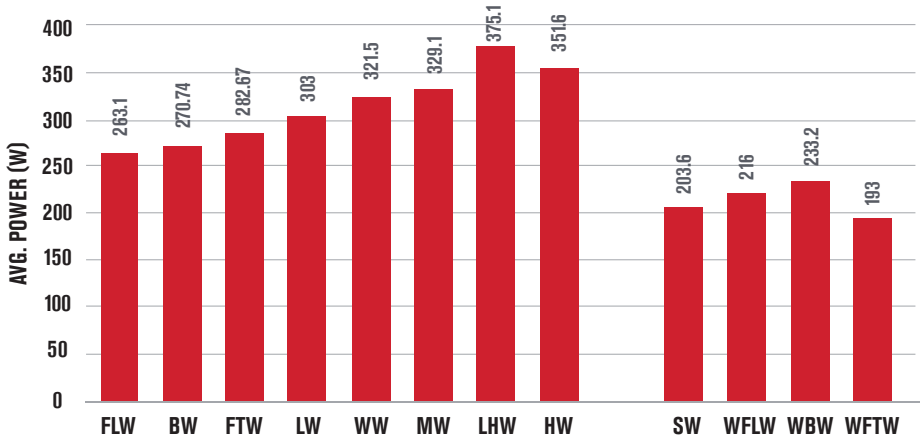


FIGURE 10.5

RELATIVE AVERAGE POWER OUTPUT (W/KG) DURING 3-MINUTE WATTBIKE MGP TEST

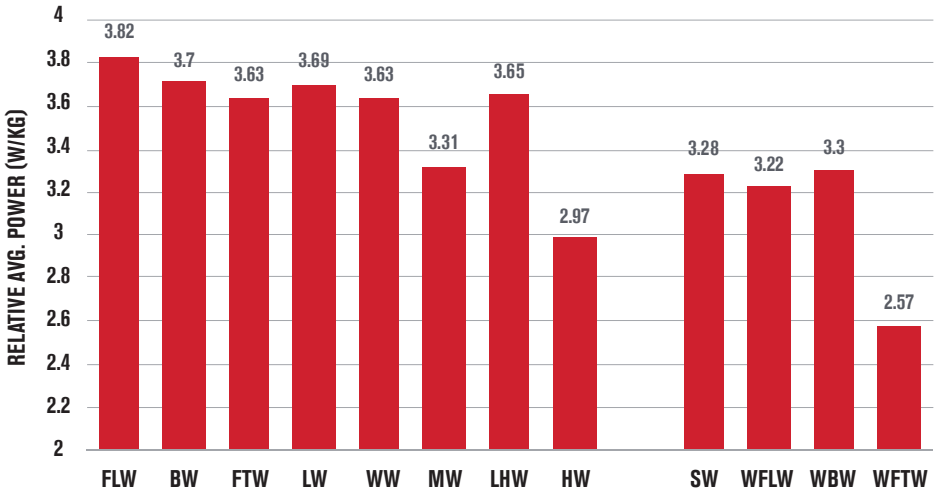


FIGURE 10.6

AVERAGE HEART RATE (BPM) DURING A 3-MINUTE GLYCOLYTIC POWER WATTBIKE MGP TEST

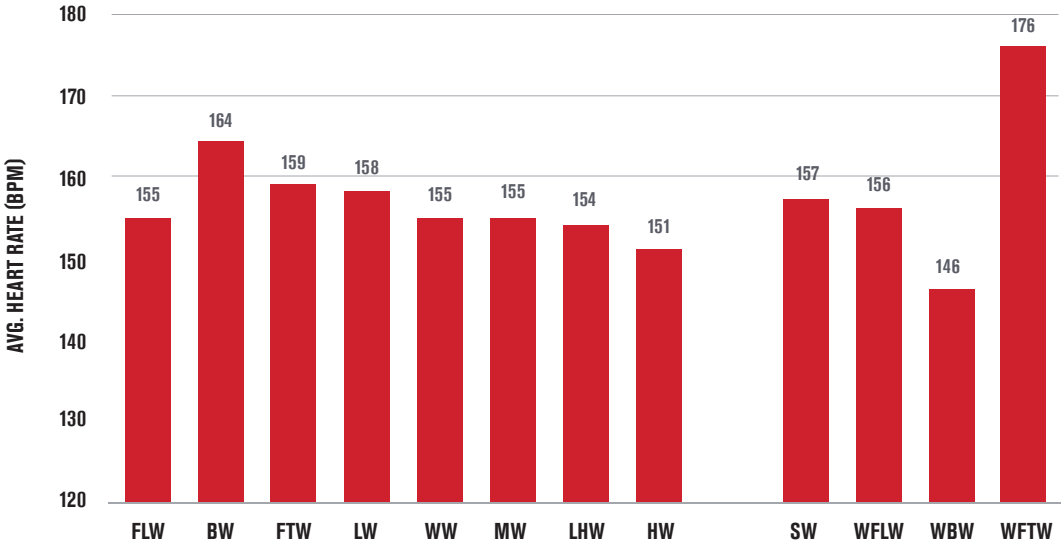


TABLE 10.3

AVERAGE POWER OUTPUT PERFORMANCE BENCHMARKS BY WEIGHT CLASS FOR 3-MINUTE WATTBIKE MGP TEST

FLW			BW			FTW			LW		
WORLD CLASS	>	291	WORLD CLASS	>	306	WORLD CLASS	>	311	WORLD CLASS	>	349
VERY GOOD	275	290	VERY GOOD	291	305	VERY GOOD	299	310	VERY GOOD	329	348
GOOD	263	274	GOOD	279	290	GOOD	290	298	GOOD	314	328
FAIR	239	262	FAIR	257	278	FAIR	272	289	FAIR	284	313
POOR	227	238	POOR	245	256	POOR	263	271	POOR	269	283
VERY POOR	211	226	VERY POOR	230	244	VERY POOR	251	262	VERY POOR	249	268
BAD	<	210	BAD	<	229	BAD	<	250	BAD	<	248

WW			MW			LHW			HW		
WORLD CLASS	>	363	WORLD CLASS	>	365	WORLD CLASS	>	398	WORLD CLASS	>	368
VERY GOOD	347	362	VERY GOOD	350	364	VERY GOOD	389	397	VERY GOOD	363	367
GOOD	334	346	GOOD	339	349	GOOD	383	388	GOOD	359	362
FAIR	310	333	FAIR	317	338	FAIR	369	382	FAIR	351	358
POOR	379	309	POOR	306	316	POOR	363	368	POOR	347	350
VERY POOR	281	378	VERY POOR	291	305	VERY POOR	354	362	VERY POOR	342	346
BAD	<	280	BAD	<	290	BAD	<	353	BAD	<	341

WSW			WFLW			WBW			WFTW		
WORLD CLASS	>	233	WORLD CLASS	>	239	WORLD CLASS	>	260	WORLD CLASS	>	219
VERY GOOD	222	232	VERY GOOD	230	238	VERY GOOD	248	259	VERY GOOD	209	218
GOOD	214	221	GOOD	223	229	GOOD	240	247	GOOD	202	208
FAIR	198	213	FAIR	209	222	FAIR	222	239	FAIR	187	201
POOR	190	197	POOR	202	208	POOR	214	221	POOR	179	186
VERY POOR	179	189	VERY POOR	193	201	VERY POOR	202	213	VERY POOR	169	178
BAD	<	178	BAD	<	192	BAD	<	201	BAD	<	168

In addition to understanding the performance variables of average power and relative average power, it is also important to consider the manner with which these results were achieved. To do this, average heart rate (HR) throughout the three-minute effort is recorded. Heart rate is a representation of the energetic cost of the three-minute effort, with higher average HR indicating greater energetic demand, and thus more likely a faster rate of fatigue (Figure 10.6).

AEROBIC CHARACTERISTICS

Aerobic ESD is crucial to the MMA fighter, as aerobic bioenergetics i) provides energy for sustained efforts throughout five-minute rounds and ii) aids a fighter's recoverability in the one-minute rest between rounds (e.g., energy pathway resynthesis) as well as following discrete high-intensity bursts of anaerobic activity (e.g., helping to overcome any oxygen deficit created by alactic and lactic energy-system work).

The UFC Performance Institute uses a capacity test, often referred to as a VO2peak or VO2max test, to objectively measure the capacity and efficiency of the aerobic system. This test can be performed through a variety of exercise modalities, including running or cycling (should injury be a consideration), but the data presented here is representative of running-based assessments only conducted by UFC fighters. Figure 10.7 shows the maximum aerobic capacity or VO2peak by weight class, with Table 10.4 showing the associated performance benchmarks.

FIGURE 10.7

PEAK AEROBIC CAPACITY (ML/KG/MIN) BY WEIGHT CLASS IN UFC FIGHTERS

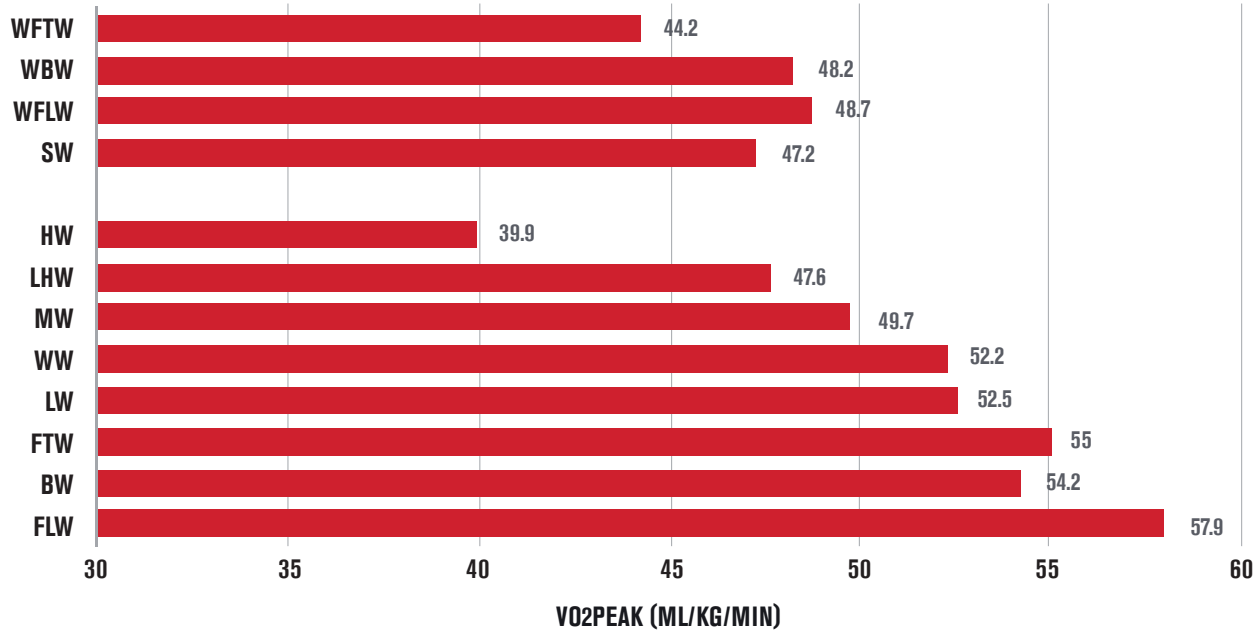


TABLE 10.4

PEAK AEROBIC CAPACITY (VO2PEAK) PERFORMANCE BENCHMARKS BY WEIGHT CLASS

FLW		
WORLD CLASS	>	70.6
VERY GOOD	65.6	65.5
GOOD	61.8	65.5
FAIR	54.2	61.7
POOR	50.4	54.1
VERY POOR	45.4	50.3
BAD	<	45.3

BW		
WORLD CLASS	>	66.3
VERY GOOD	61.5	66.2
GOOD	57.9	61.4
FAIR	50.7	57.8
POOR	47.1	50.6
VERY POOR	42.3	47.0
BAD	<	42.2

FTW		
WORLD CLASS	>	63.9
VERY GOOD	60.4	63.8
GOOD	57.7	60.3
FAIR	52.5	57.6
POOR	49.8	52.4
VERY POOR	46.3	49.7
BAD	<	46.2

LW		
WORLD CLASS	>	64.8
VERY GOOD	59.9	64.7
GOOD	56.3	59.8
FAIR	48.9	56.2
POOR	45.3	48.8
VERY POOR	40.2	45.2
BAD	<	40.3

WW		
WORLD CLASS	>	66.1
VERY GOOD	60.6	66.0
GOOD	56.4	60.5
FAIR	48.2	56.3
POOR	44.0	48.1
VERY POOR	38.5	43.9
BAD	<	38.4

MW		
WORLD CLASS	>	60.8
VERY GOOD	56.4	60.7
GOOD	53.1	56.3
FAIR	46.5	53.0
POOR	43.2	46.4
VERY POOR	38.8	38.7
BAD	<	

LHW		
WORLD CLASS	>	58.9
VERY GOOD	54.4	58.8
GOOD	51.1	54.3
FAIR	44.3	51.0
POOR	41.0	44.2
VERY POOR	36.5	40.9
BAD	<	36.4

HW		
WORLD CLASS	>	52.2
VERY GOOD	47.3	52.1
GOOD	43.7	47.2
FAIR	36.3	43.6
POOR	32.7	36.2
VERY POOR	27.8	32.6
BAD	<	27.7

WSW		
WORLD CLASS	>	57.1
VERY GOOD	53.2	57.0
GOOD	50.2	53.1
FAIR	44.4	50.1
POOR	41.4	44.3
VERY POOR	37.5	41.3
BAD	<	37.4

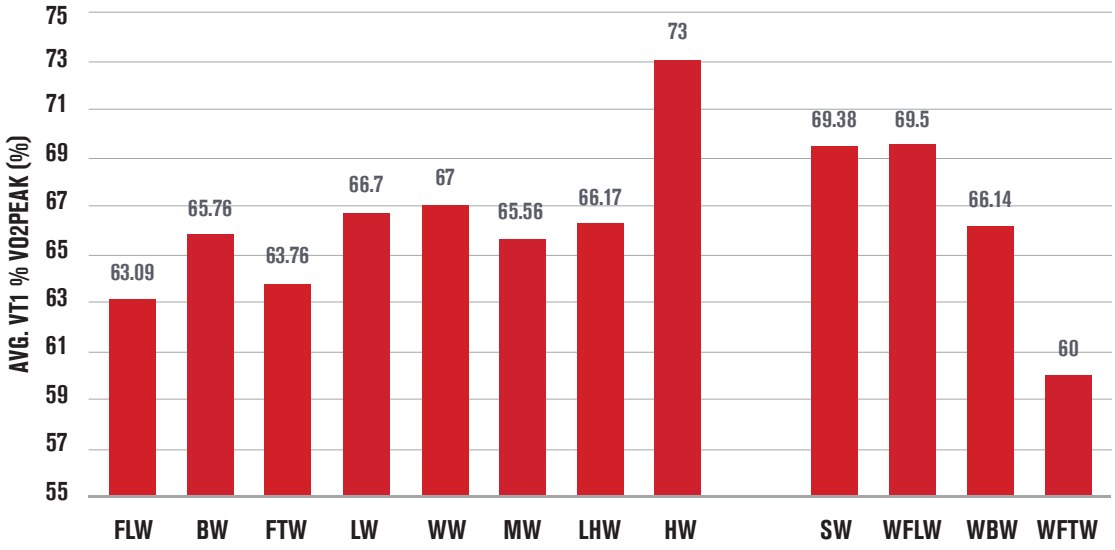
WFLW		
WORLD CLASS	>	58.4
VERY GOOD	54.6	58.3
GOOD	51.7	54.5
FAIR	45.9	51.6
POOR	43.0	45.8
VERY POOR	39.2	42.9
BAD	<	39.1

WBW		
WORLD CLASS	>	61.9
VERY GOOD	56.5	61.8
GOOD	52.4	56.4
FAIR	44.2	52.3
POOR	40.1	44.1
VERY POOR	34.7	40.0
BAD	<	34.6

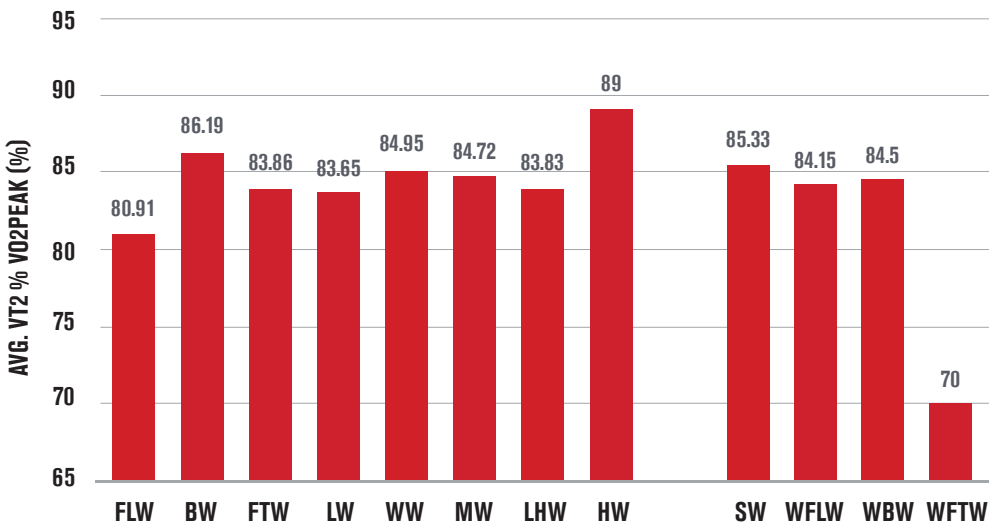
WFTW		
WORLD CLASS	>	51.5
VERY GOOD	48.6	51.4
GOOD	46.5	48.5
FAIR	42.1	46.4
POOR	40.0	42.0
VERY POOR	37.1	39.9
BAD	<	37.0

FIGURE 10.8

THE AVERAGE FIRST (A) AND SECOND (B) VENTILATORY THRESHOLD AS A PERCENTAGE OF VO2PEAK BY WEIGHT CLASS IN UFC FIGHTERS



(A)

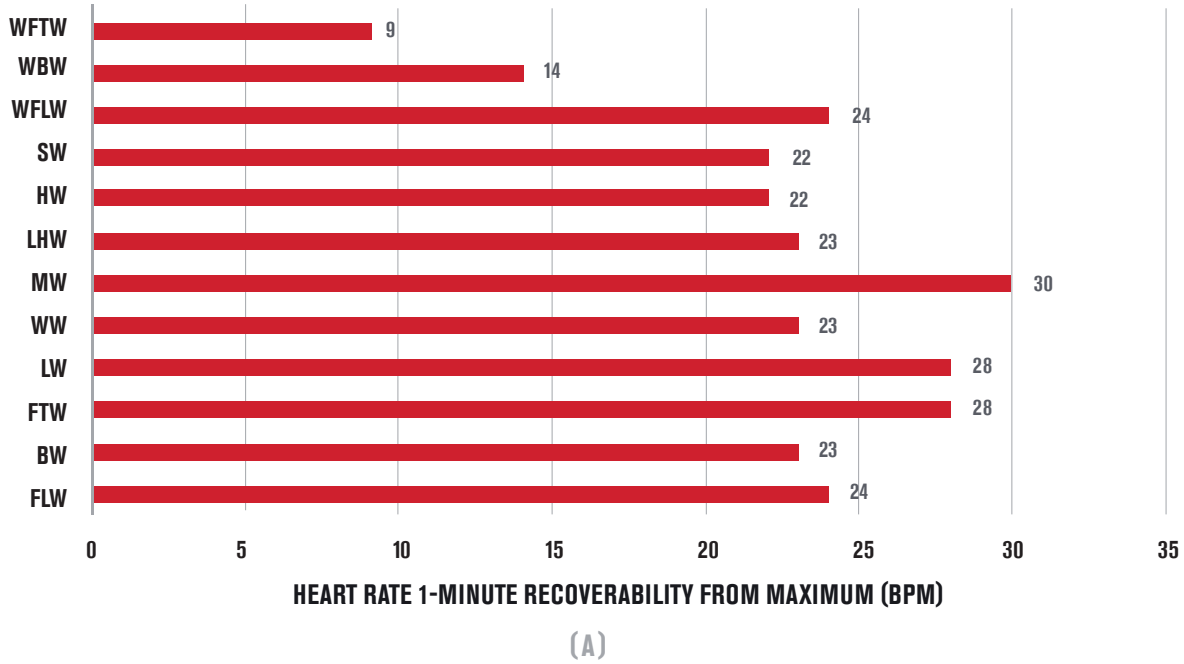


(B)

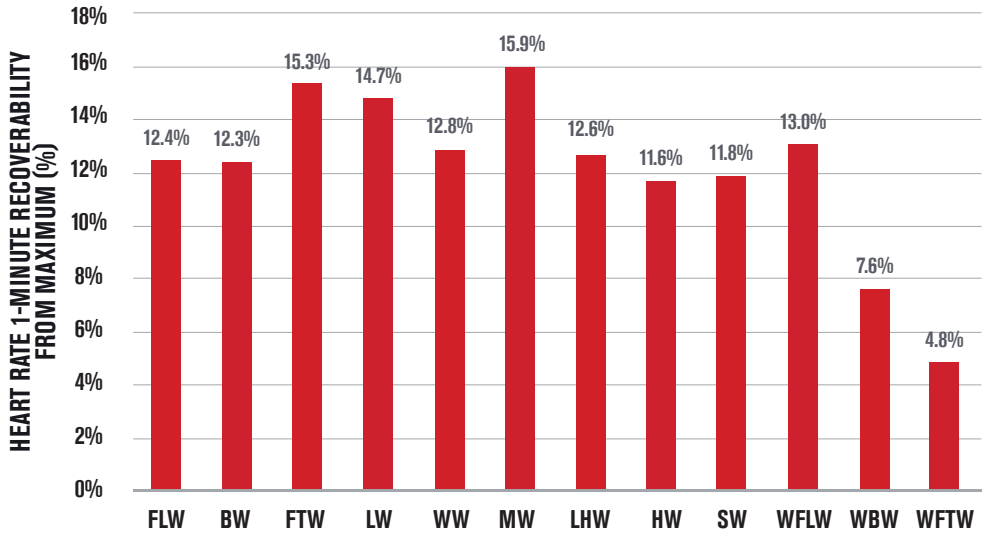
Ventilatory thresholds from the VO2peak test can also be used to gain insight into the physiological response of the body as it transitions from aerobic energy production (i.e., low to moderate intensity) to anaerobic energy production (i.e., high to very high intensity). The ventilatory breakpoints are associated with key thresholds in bioenergetics. The first ventilatory threshold (VT1) is often associated with the anaerobic threshold and is the point at which lactate begins to accumulate in the blood. This threshold is associated with increased respiration rates and the steady increase of circulating lactate with increasing intensity (i.e., speed or incline). The second ventilatory threshold (VT2) is often referred to as the lactate turnpoint and is indicative of high levels of lactate accumulation within the body. At this point, lactate production has largely overtaken lactate removal. In principle, the more delayed the onset of VT1 and VT2, the more efficient the athlete is at utilizing oxygen for energy production, and therefore the onset of fatigue is more prolonged. Figure 10.8 indi-

FIGURE 10.9

ONE-MINUTE HR RECOVERABILITY IN ABSOLUTE UNITS (A) AND PERCENTAGE OF PEAK HR (B) BY WEIGHT CLASS IN UFC FIGHTERS



(A)



(B)

cates the relative VO2 equivalent (% VO2peak) at which VT1 (A) and VT2 (B) are achieved. Tables 10.5 and 10.6 presents the performance benchmarks by weight class for VT1 and VT2, respectively.

Given the one-minute rest periods in MMA, recoverability is another key aerobic component of a fighter's ESD. Insight into a fighter's recoverability can be determined by assessing the difference between their peak HR in the VO2peak test and their HR at one minute following the completion of the test. This difference can be interpreted in absolute units (i.e., beats per minute, BPM) or as a percentage. The one-minute heart rate recoverability by weight class for UFC fighters in absolute units (BPM) and percentage of peak HR is displayed in Figure 10.9, with the associated performance benchmarks for one-minute heart rate recoverability displayed in Table 10.5.



TABLE 10.5

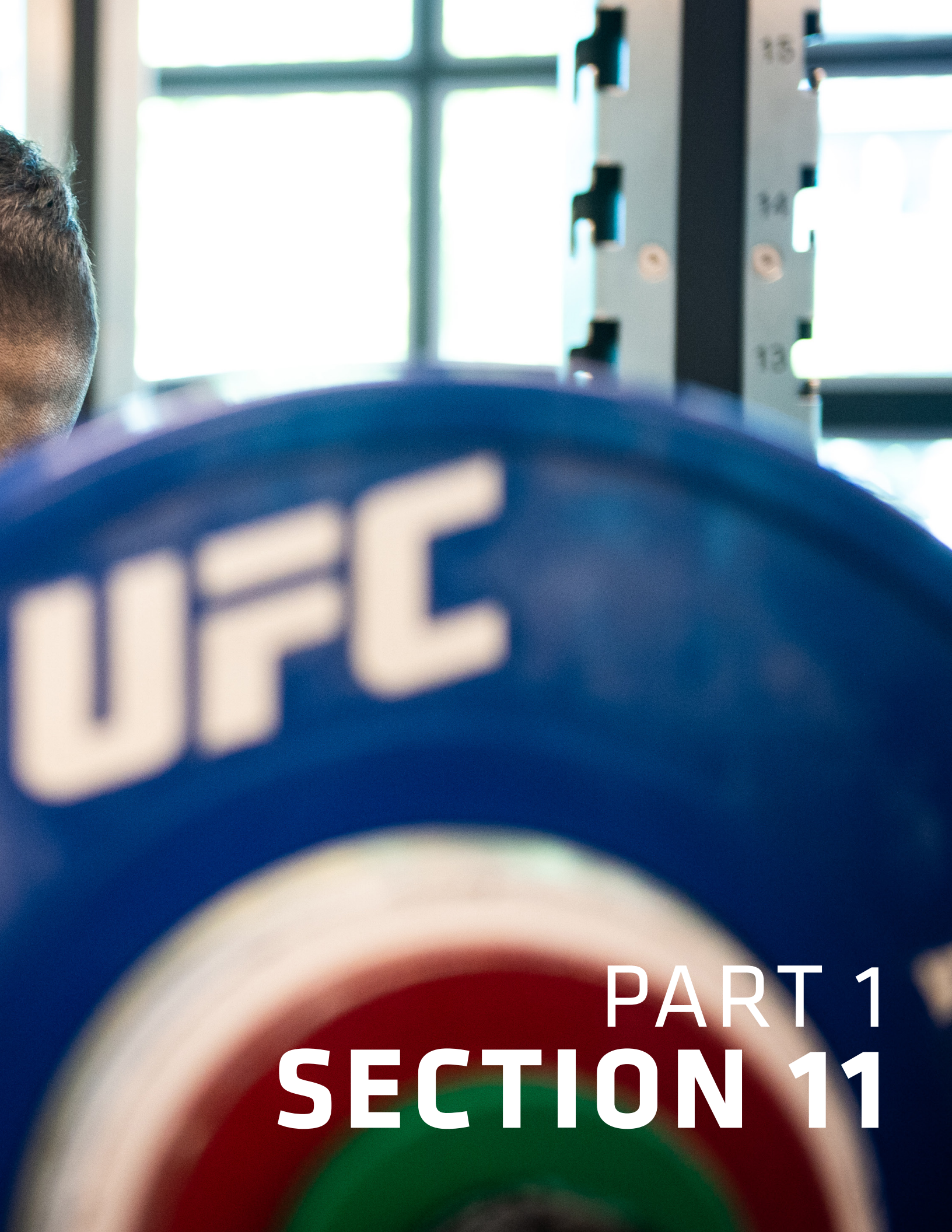
PERFORMANCE BENCHMARKS FOR ONE-MINUTE HEART RATE RECOVERABILITY BY WEIGHT CLASS

FLW			BW			FTW			LW		
WORLD CLASS	>	38	WORLD CLASS	>	47	WORLD CLASS	>	32	WORLD CLASS	>	35
VERY GOOD	32	37	VERY GOOD	41	46	VERY GOOD	29	31	VERY GOOD	30	34
GOOD	28	31	GOOD	36	40	GOOD	26	28	GOOD	27	29
FAIR	20	27	FAIR	26	35	FAIR	22	25	FAIR	19	26
POOR	16	19	POOR	21	25	POOR	19	21	POOR	16	18
VERY POOR	10	15	VERY POOR	15	20	VERY POOR	16	18	VERY POOR	11	15
BAD	<	9	BAD	<	14	BAD	<	15	BAD	<	10

WW			MW			LHW			HW		
WORLD CLASS	>	36	WORLD CLASS	>	41	WORLD CLASS	>	22	WORLD CLASS	>	17
VERY GOOD	31	35	VERY GOOD	35	40	VERY GOOD	19	21	VERY GOOD	14	16
GOOD	27	30	GOOD	30	34	GOOD	17	18	GOOD	12	13
FAIR	19	26	FAIR	20	29	FAIR	13	16	FAIR	8	11
POOR	15	18	POOR	15	19	POOR	11	12	POOR	6	7
VERY POOR	10	14	VERY POOR	9	14	VERY POOR	8	10	VERY POOR	3	5
BAD	<	9	BAD	<	8	BAD	<	7	BAD	<	2

WSW			WFLW			WBW			WFTW		
WORLD CLASS	>	41	WORLD CLASS	>	35	WORLD CLASS	>	40	WORLD CLASS	>	36
VERY GOOD	35	40	VERY GOOD	31	34	VERY GOOD	35	39	VERY GOOD	33	25
GOOD	30	34	GOOD	27	30	GOOD	32	34	GOOD	31	32
FAIR	20	29	FAIR	21	26	FAIR	26	31	FAIR	27	30
POOR	15	19	POOR	17	20	POOR	22	25	POOR	25	26
VERY POOR	9	14	VERY POOR	13	16	VERY POOR	18	21	VERY POOR	22	24
BAD	<	8	BAD	<	12	BAD	<	17	BAD	<	21


ESP
45



PART 1

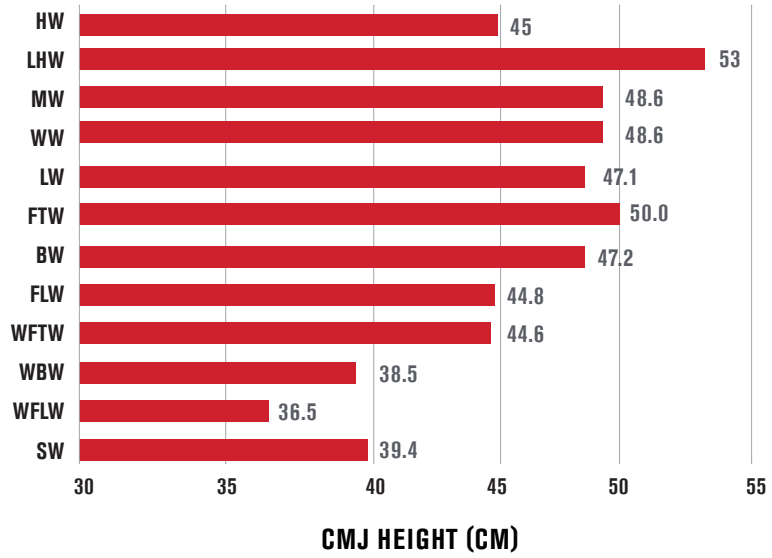
SECTION 11

SECTION 11: STRENGTH & POWER

By Duncan French and Kyle Larimer

All combat sports, including MMA, require muscular force to be repeatedly exerted against an external resistance in the form of an opponent. The application of this force can be expressed in many different ways. For example, high muscular force, or strength, can be expressed at low to very low velocities in many grappling and wrestling actions or during clinch work and pummelling against the fence. In comparison, moderate to high velocity force expression, or power, is demonstrated in all striking techniques where limbs are thrown at high speeds against an opponent's body, as well as during explosive movements such as defensive sprawls and scrambles that must be executed in a fraction of a second. In considering the strength and power characteristics of MMA, it is possible to argue that maximal or near-maximal strength levels, strength endurance or the repetitive expression of moderate to high force, and explosive speed-strength efforts expressing high power outputs are all required in certain situations. Indeed, MMA fighters require a variety of strength and power qualities across the force-velocity continuum in order to perform many of the technical skills required within the sport. The need for MMA fighters to develop high levels of strength and power is therefore necessary for success.

FIGURE 11.1
PEAK CMJ HEIGHT AVERAGE FOR EACH UFC WEIGHT CLASS



The profiles of individual fighting styles suggest that strength and power have a significant role to play in supporting their technical requirements. Explosive striking sports such as taekwondo and kickboxing are found to generate high levels of muscular power, with kicking impact velocities recorded as fast as 7.3-14.4m/s-1, punching impact velocities between 8.9-9.1m/s-1, and elbow impact velocities 4.4-8.2m/s-1. However, maximal strength levels in these "striking" sports are often low (with forces of up to 1.8 x body weight) in comparison to some of their combat sport peers. For example, wrestlers and judo players have been found to generate forces more than 4.5 x bodyweight as they lift and throw their opponents. Therefore, clearly, there are stylistic biases that influence strength and power expression within the discrete styles of many combat sports. As MMA is a combination of all combat techniques, MMA fighters must have the capacity to not only generate large amounts of force, but at the same time, have the ability to produce maximal power in very short periods of time. The strength and power characteristics of MMA fighters represent some of the most diverse requirements in all of sport. Here we present insights into the strength and power characteristics of world-class MMA fighters competing in UFC.

LOWER-BODY POWER

The ability to produce force at moderate to high velocities (i.e., muscular power) influences many aspects of MMA performance. For example, the majority of striking (i.e., punches, elbows, knees, kicks) force is generated through the rapid translation of ground reaction force through the legs to throw kicks, punches or flying knees or allowing a fighter to move around the Octagon in an agile fashion while rapidly changing direction. The countermovement jump (CMJ) test is a globally recognized, non-sport specific assessment of lower-body power, often performed on a force plate that is used to measure ground reaction forces. Using an indirect calculation of jump height through the impulse-momentum relationship, Figure 11.1 presents average CMJ height as a performance measure for all UFC weight classes. Table 11.1 presents the UFC performance benchmarks for CMJ height by weight class for comparative purposes.

TABLE 11.1

PEAK JUMP HEIGHT PERFORMANCE BENCHMARKS BY WEIGHT CLASS FOR THE CMJ TEST

FLW		
WORLD CLASS	>	59.3
VERY GOOD	53.5	59.2
GOOD	49.2	53.4
FAIR	40.6	49.1
POOR	36.3	40.5
VERY POOR	30.5	36.2
BAD	<	30.4

BW		
WORLD CLASS	>	56.5
VERY GOOD	52.8	56.4
GOOD	50.1	52.7
FAIR	44.5	50.0
POOR	41.8	44.4
VERY POOR	38.1	41.7
BAD	<	38.0

FTW		
WORLD CLASS	>	60.9
VERY GOOD	56.6	60.8
GOOD	53.3	56.5
FAIR	46.9	53.2
POOR	43.6	46.8
VERY POOR	39.3	43.5
BAD	<	39.2

LW		
WORLD CLASS	>	58.2
VERY GOOD	53.8	58.1
GOOD	50.5	53.7
FAIR	43.9	50.4
POOR	40.6	43.8
VERY POOR	36.2	40.5
BAD	<	36.1

WW		
WORLD CLASS	>	59.9
VERY GOOD	55.4	59.8
GOOD	52.1	55.3
FAIR	45.3	52.0
POOR	42.0	45.2
VERY POOR	37.5	41.9
BAD	<	37.4

MW		
WORLD CLASS	>	60.3
VERY GOOD	55.7	60.2
GOOD	52.2	55.6
FAIR	45.2	52.1
POOR	41.7	45.1
VERY POOR	37.1	41.6
BAD	<	37.0

LHW		
WORLD CLASS	>	65.7
VERY GOOD	60.7	65.6
GOOD	56.9	60.6
FAIR	49.3	56.8
POOR	45.5	49.2
VERY POOR	40.5	45.4
BAD	<	40.4

HW		
WORLD CLASS	>	63.7
VERY GOOD	56.3	63.6
GOOD	50.7	56.2
FAIR	39.5	50.6
POOR	33.9	39.4
VERY POOR	26.5	33.8
BAD	<	26.4

WSW		
WORLD CLASS	>	47.5
VERY GOOD	44.3	47.4
GOOD	41.9	44.2
FAIR	37.1	41.8
POOR	34.7	37.0
VERY POOR	31.5	34.6
BAD	<	31.4

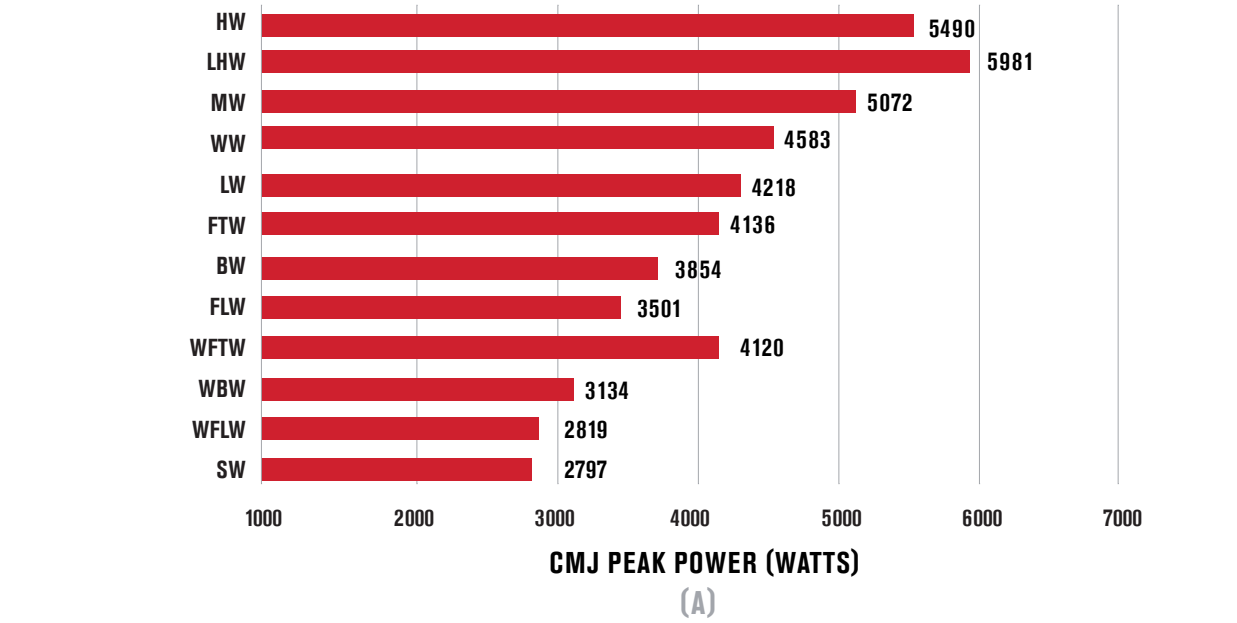
WFLW		
WORLD CLASS	>	44.2
VERY GOOD	41.2	44.1
GOOD	38.9	41.1
FAIR	34.3	38.8
POOR	32.0	34.2
VERY POOR	29.0	31.9
BAD	<	28.9

WBW		
WORLD CLASS	>	46.6
VERY GOOD	43.4	46.5
GOOD	41.0	43.3
FAIR	36.2	40.9
POOR	33.8	36.1
VERY POOR	30.6	33.7
BAD	<	30.5

WFTW		
WORLD CLASS	>	52.7
VERY GOOD	49.5	52.6
GOOD	47.1	49.4
FAIR	42.3	47.0
POOR	39.9	42.2
VERY POOR	36.7	39.8
BAD	<	36.6

FIGURE 11.2

PEAK POWER (A), AND RELATIVE PEAK POWER (B) AVERAGE FOR EACH UFC WEIGHT CLASS ACHIEVED DURING A CMJ TEST



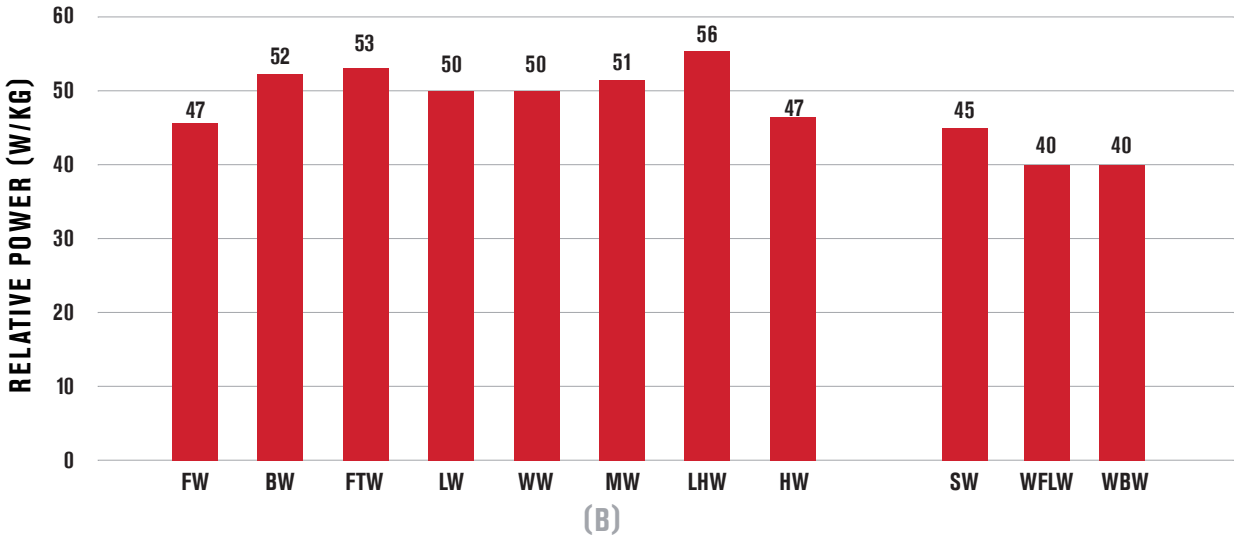


Figure 11.2 shows both the maximal power achieved during a countermovement jump test across all weight classes, as well as the relative power normalized by bodyweight for comparative purposes. Table 11.2 presents the performance benchmarks by weight class for CMJ peak power.

TABLE 11.2

PEAK POWER PERFORMANCE BENCHMARKS BY WEIGHT CLASS FOR THE CMJ TEST

FLW			BW			FTW			LW		
WORLD CLASS	>	5656	WORLD CLASS	>	6213	WORLD CLASS	>	7280	WORLD CLASS	>	7553
VERY GOOD	5227	5655	VERY GOOD	5757	6212	VERY GOOD	6761	7279	VERY GOOD	6728	7552
GOOD	4906	5226	GOOD	5415	5756	GOOD	6371	6760	GOOD	6110	6727
FAIR	4262	4905	FAIR	4731	5414	FAIR	5593	6370	FAIR	4872	6109
POOR	3941	4262	POOR	4389	4730	POOR	5203	5592	POOR	4254	4871
VERY POOR	3515	3940	VERY POOR	3933	4388	VERY POOR	4684	5202	VERY POOR	3429	4253
BAD	<	3514	BAD	<	3932	BAD	<	4683	BAD	<	3428

WW			MW			LHW			HW		
WORLD CLASS	>	4204	WORLD CLASS	>	4701	WORLD CLASS	>	5017	WORLD CLASS	>	5033
VERY GOOD	3923	4203	VERY GOOD	4363	4700	VERY GOOD	4665	5016	VERY GOOD	4707	5032
GOOD	3713	3922	GOOD	4109	4362	GOOD	4401	4664	GOOD	4463	4706
FAIR	3291	3712	FAIR	3601	4108	FAIR	3873	4400	FAIR	3975	4462
POOR	3081	3290	POOR	3347	3600	POOR	3609	3872	POOR	3731	3974
VERY POOR	2800	3080	VERY POOR	3009	3346	VERY POOR	3257	3608	VERY POOR	3405	3730
BAD	<	2799	BAD	<	3008	BAD	<	3256	BAD	<	3404

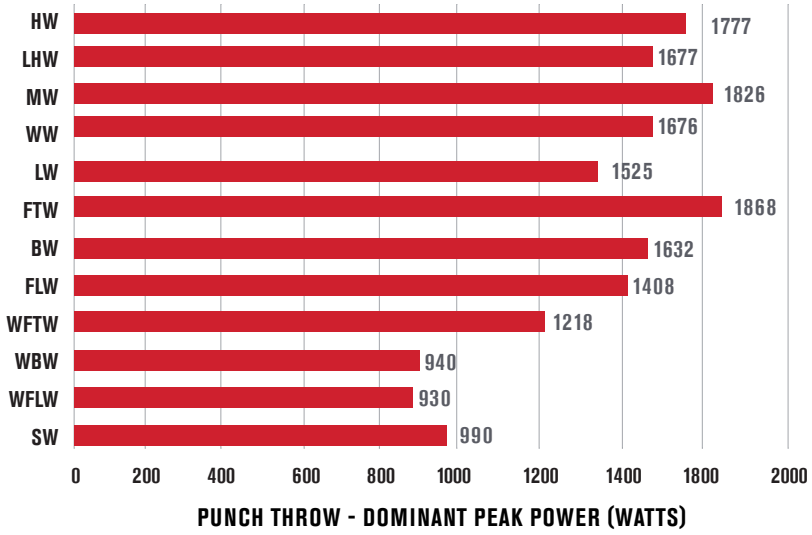
WSW			WFLW			WBW			WFTW		
WORLD CLASS	>	3438	WORLD CLASS	>	3414	WORLD CLASS	>	3673	WORLD CLASS	>	4659
VERY GOOD	3182	3437	VERY GOOD	3176	3413	VERY GOOD	3458	3672	VERY GOOD	4444	4658
GOOD	2990	3182	GOOD	2998	3175	GOOD	3296	3457	GOOD	4282	443
FAIR	2606	2989	FAIR	2642	2997	FAIR	2974	3295	FAIR	3960	4282
POOR	2414	2605	POOR	2464	2641	POOR	2812	2973	POOR	3798	3959
VERY POOR	2458	2413	VERY POOR	2226	2463	VERY POOR	2597	2811	VERY POOR	3583	3797
BAD	<	2457	BAD	<	2225	BAD	<	2596	BAD	<	3582



UPPER-BODY POWER

Like lower-body power, upper-body power characteristics are considered essential for MMA. Not only is upper-body power critical for throwing knockout punches and elbows, but power needs to be expressed for other actions such as rapidly framing an opponent to escape during grappling exchanges or snapping down an opponent to gain top position in the clinch. As a specific test for measuring upper body power, the UFC PI adopts a Landmine Punch Throw, in which peak power for the dominant and non-dominant hand are recorded using a linear position transducer (GymAware, Kinetic Performance). This test is evaluated using three progressive loads to determine an athlete's upper-body power force-velocity profile (Table 11.3). This force-velocity profile indicates whether the fighter needs to train maximal force or maximal velocity to improve his or her overall upper power output. Meanwhile, the peak power achieved at the lowest load (as it is the closest to competition environment—e.g., throwing a punch with MMA gloves on) is recorded for comparison between fighters (Figure 11.3). Tables 11.4A and B present the performance benchmarks by weight class for landmine punch throw peak power in dominant and non-dominant arms. The average asymmetry between dominant and non-dominant arms across the UFC weight classes is also presented in Figure 11.6.

FIGURE 11.3
THE PEAK POWER FOR THE DOMINANT AND NON-DOMINANT ARM AVERAGE FOR EACH UFC WEIGHT CLASS ACHIEVED DURING A LANDMINE PUNCH THROW TEST



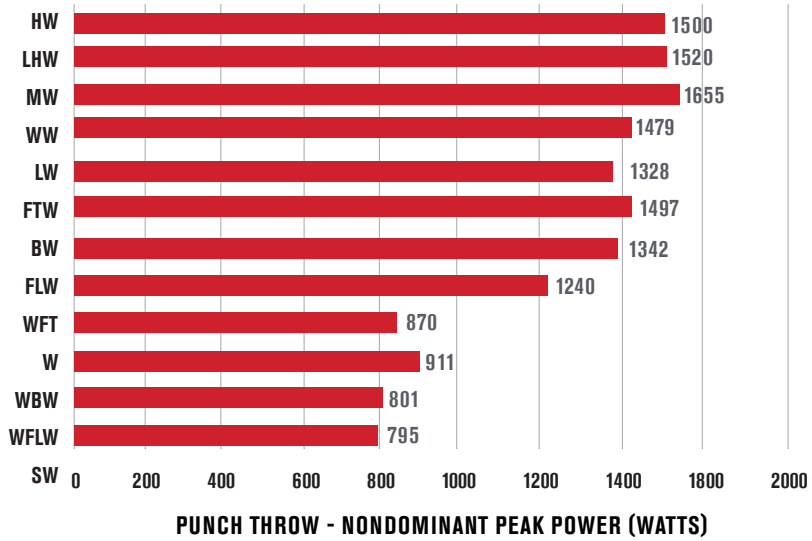


TABLE 11.3
RESPECTIVE LOADS USED BY WEIGHTCLASS FOR THE LANDMINE PUNCH THROW TEST

	WEIGHT (KG)
FW, BW, FTW	20, 25, 30
LW, WW, MW	25, 30, 35
LHW, HW	30, 35, 40
SW, WFW, WBW	15, 20, 25

Note: A 15kg barbell is utilized for women, and a 20kg barbell is utilized for men. All additional loads are added to this equipment in 5kg increments.

TABLE 11.4

PEAK POWER (W) PERFORMANCE BENCHMARKS BY WEIGHT CLASS FOR THE LANDMINE PUNCH THROW TEST IN THE DOMINANT (A) AND NON-DOMINANT (B) ARMS

FLW		
WORLD CLASS	>	2091
VERY GOOD	1818	2090
GOOD	1614	1817
FAIR	1204	1613
POOR	1000	1203
VERY POOR	727	999
BAD	<	726

BW		
WORLD CLASS	>	2373
VERY GOOD	2077	2372
GOOD	1855	2076
FAIR	1411	1854
POOR	1189	1410
VERY POOR	893	1188
BAD	<	892

FTW		
WORLD CLASS	>	2539
VERY GOOD	2271	2538
GOOD	2070	2270
FAIR	1668	2069
POOR	1467	1667
VERY POOR	1199	1466
BAD	<	1198

LW		
WORLD CLASS	>	2300
VERY GOOD	1990	2299
GOOD	1758	1989
FAIR	1297	1757
POOR	1062	1296
VERY POOR	752	1062
BAD	<	751

WW		
WORLD CLASS	>	2377
VERY GOOD	2097	2376
GOOD	1887	2096
FAIR	1467	1886
POOR	1257	1466
VERY POOR	977	1256
BAD	<	976

MW		
WORLD CLASS	>	2661
VERY GOOD	2327	2660
GOOD	2077	2326
FAIR	1577	2076
POOR	1327	1576
VERY POOR	993	1326
BAD	<	992

LHW		
WORLD CLASS	>	2546
VERY GOOD	2199	2545
GOOD	1938	2198
FAIR	1418	1937
POOR	1157	1417
VERY POOR	810	1156
BAD	<	809

HW		
WORLD CLASS	>	2234
VERY GOOD	2052	2233
GOOD	1915	2053
FAIR	1641	1914
POOR	1504	1640
VERY POOR	1322	1503
BAD	<	1321

WSW		
WORLD CLASS	>	1375
VERY GOOD	1221	1374
GOOD	1106	1220
FAIR	876	1105
POOR	761	875
VERY POOR	607	760
BAD	<	606

WFLW		
WORLD CLASS	>	1283
VERY GOOD	1142	1282
GOOD	1037	1141
FAIR	825	1036
POOR	720	824
VERY POOR	579	719
BAD	<	578

WBW		
WORLD CLASS	>	1263
VERY GOOD	1134	1262
GOOD	1038	1133
FAIR	844	1037
POOR	748	843
VERY POOR	619	747
BAD	<	618

WFTW		
WORLD CLASS	>	1541
VERY GOOD	1412	1540
GOOD	1316	1411
FAIR	1122	1315
POOR	1026	1121
VERY POOR	897	1025
BAD	<	896

(A)

FLW		
WORLD CLASS	>	1711
VERY GOOD	1523	170
GOOD	1382	1522
FAIR	1100	1381
POOR	959	1099
VERY POOR	771	958
BAD	<	770

BW		
WORLD CLASS	>	1893
VERY GOOD	1673	1892
GOOD	1508	1672
FAIR	1178	1507
POOR	1013	1177
VERY POOR	793	1012
BAD	<	792

FTW		
WORLD CLASS	>	1916
VERY GOOD	1749	1915
GOOD	1623	1748
FAIR	1373	1622
POOR	1247	1372
VERY POOR	1080	1246
BAD	<	1079

LW		
WORLD CLASS	>	1739
VERY GOOD	1575	1738
GOOD	1452	1574
FAIR	1206	1451
POOR	1083	1205
VERY POOR	919	1082
BAD	<	918

WW		
WORLD CLASS	>	2158
VERY GOOD	1887	2157
GOOD	1683	1886
FAIR	1277	1682
POOR	1073	1276
VERY POOR	802	1072
BAD	<	801

MW		
WORLD CLASS	>	2256
VERY GOOD	2016	2255
GOOD	1836	2015
FAIR	1476	1835
POOR	1296	1475
VERY POOR	1056	1295
BAD	<	1055

LHW		
WORLD CLASS	>	1979
VERY GOOD	1796	1978
GOOD	1658	1795
FAIR	1384	1657
POOR	1246	1383
VERY POOR	1063	1245
BAD	<	1062

HW		
WORLD CLASS	>	2079
VERY GOOD	1848	2078
GOOD	1674	1847
FAIR	1328	1673
POOR	1154	1327
VERY POOR	923	1153
BAD	<	921

WSW		
WORLD CLASS	>	1088
VERY GOOD	971	1087
GOOD	884	970
FAIR	708	883
POOR	621	707
VERY POOR	504	620
BAD	<	503

WFLW		
WORLD CLASS	>	1106
VERY GOOD	984	1105
GOOD	893	983
FAIR	711	892
POOR	620	710
VERY POOR	498	619
BAD	<	497

WBW		
WORLD CLASS	>	1342
VERY GOOD	1170	1341
GOOD	1041	1169
FAIR	783	1040
POOR	654	782
VERY POOR	482	653
BAD	<	481

WFTW		
WORLD CLASS	>	1301
VERY GOOD	1128	1300
GOOD	1000	1127
FAIR	742	999
POOR	613	741
VERY POOR	441	612
BAD	<	440

(B)

FIGURE 11.4
THE AVERAGE ASYMMETRY IN PEAK POWER FOR THE DOMINANT AND NON-DOMINANT ARM IN UFC FIGHTERS

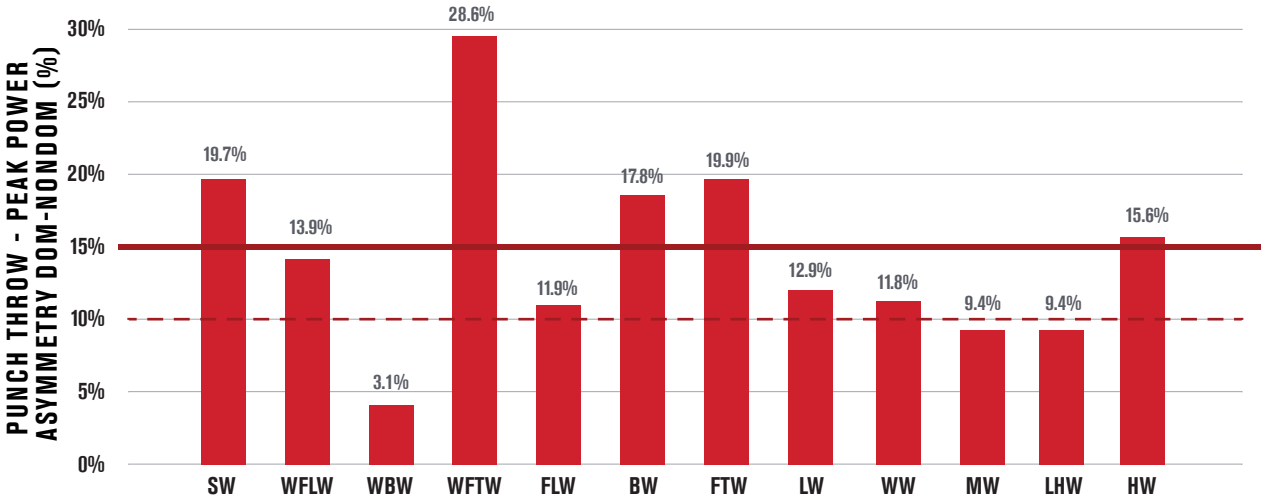


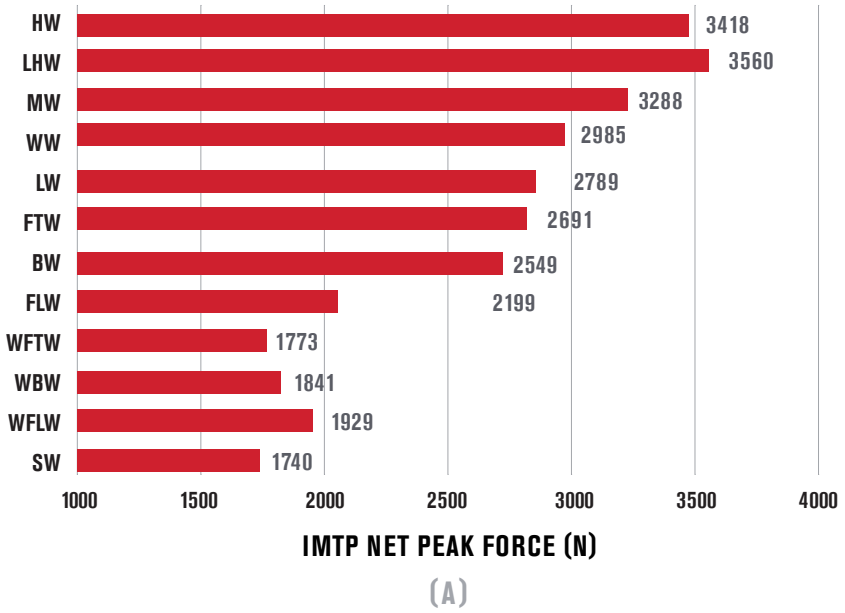
Figure 11.4 shows the average asymmetry in peak power for the dominant and non-dominant arm for each UFC weight class achieved during a landmine punch throw test. The solid line indicates a dominant arm peak power of more than 15 percent of the non-dominant arm; whereas the dotted red line indicates a dominant arm peak power of more than 10 percent of the non-dominant arm.

MAXIMUM STRENGTH AND RATE-OF-FORCE DEVELOPMENT

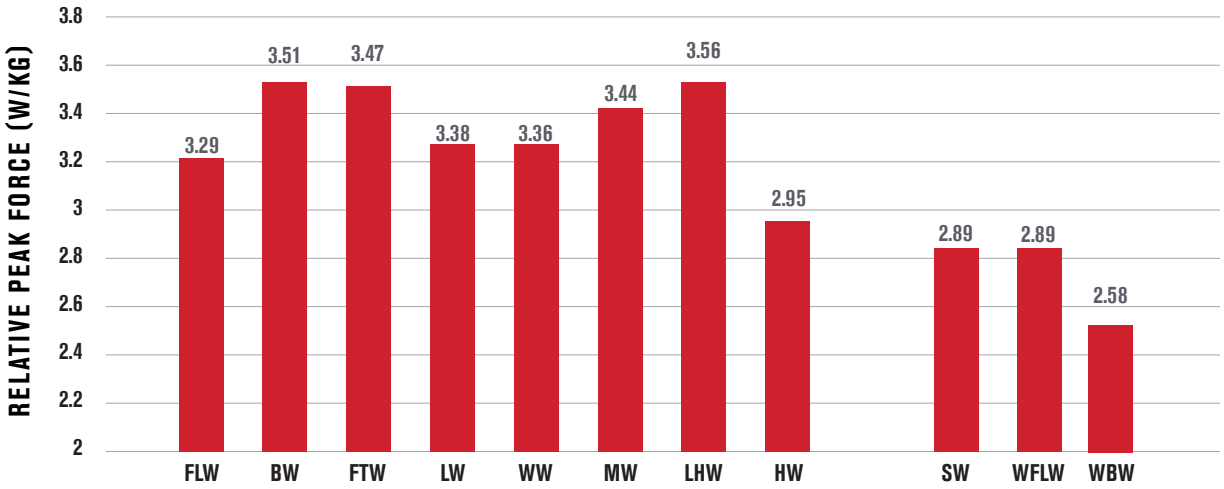
The ability to generate large amounts of force, often referred to as strength, is essential for MMA. Not only is force expression required when trying to manipulate an opponent and create advantageous positions, but an athlete's capacity to generate muscular force is also fundamental to power production (i.e., force x velocity = power). If athletes neglect to enhance their force-generating capabilities, but only seek to increase speed (e.g., hand speed), power output in striking and other explosive movements will never be maximized. Instead, research indicates that power output can be improved by simply getting stronger alone. When strength and speed are trained concurrently, power output or speed-strength can be elevated even more significantly. As a method to evaluate whole-body maximal strength, the UFC PI adopts an isometric mid-thigh pull (IMTP), performed on instrumented force plates that measure ground reaction forces. Figure 11.5 presents the IMTP net peak force production characteristics for UFC fighters across all weight divisions. IMTP performance benchmarks by weight class are presented in Table 11.5.

FIGURE 11.5

AVERAGE NET PEAK FORCE (A) AND AVERAGE RELATIVE PEAK FORCE (B) DURING 6-SECOND IMTP TEST



(A)



(B)

TABLE 11.5

AVERAGE NET FORCE (N) PERFORMANCE BENCHMARKS BY WEIGHT CLASS FOR THE IMTP TEST

FLW		
WORLD CLASS	>	2918
VERY GOOD	2631	2917
GOOD	2415	2630
FAIR	1985	2414
POOR	1769	1984
VERY POOR	1482	1768
BAD	<	1481

BW		
WORLD CLASS	>	3390
VERY GOOD	3054	3389
GOOD	2802	3053
FAIR	2298	2801
POOR	2046	2297
VERY POOR	1710	2045
BAD	<	1709

FTW		
WORLD CLASS	>	3572
VERY GOOD	3220	3571
GOOD	2956	3219
FAIR	2428	2855
POOR	2164	2427
VERY POOR	1812	2163
BAD	<	1811

LW		
WORLD CLASS	>	3874
VERY GOOD	3440	3873
GOOD	3115	3439
FAIR	2465	3114
POOR	2140	2464
VERY POOR	1706	2139
BAD	<	1705

WW		
WORLD CLASS	>	4154
VERY GOOD	3687	4153
GOOD	3336	3686
FAIR	2636	3335
POOR	2285	2635
VERY POOR	1818	2284
BAD	<	1817

MW		
WORLD CLASS	>	4859
VERY GOOD	4231	4858
GOOD	3760	4230
FAIR	2818	3756
POOR	2347	2817
VERY POOR	1719	2346
BAD	<	1718

LHW		
WORLD CLASS	>	5131
VERY GOOD	4503	5130
GOOD	4032	4502
FAIR	3090	4031
POOR	2619	3089
VERY POOR	1991	2618
BAD	<	1990

HW		
WORLD CLASS	>	4819
VERY GOOD	4259	4818
GOOD	3839	4258
FAIR	2999	3838
POOR	2579	2998
VERY POOR	2019	2578
BAD	<	2018

WSW		
WORLD CLASS	>	2657
VERY GOOD	2291	2656
GOOD	2016	2290
FAIR	1466	2015
POOR	1191	1465
VERY POOR	825	1190
BAD	<	825

WFLW		
WORLD CLASS	>	2432
VERY GOOD	2231	2431
GOOD	2081	2230
FAIR	1779	2080
POOR	1629	1778
VERY POOR	1428	1628
BAD	<	1427

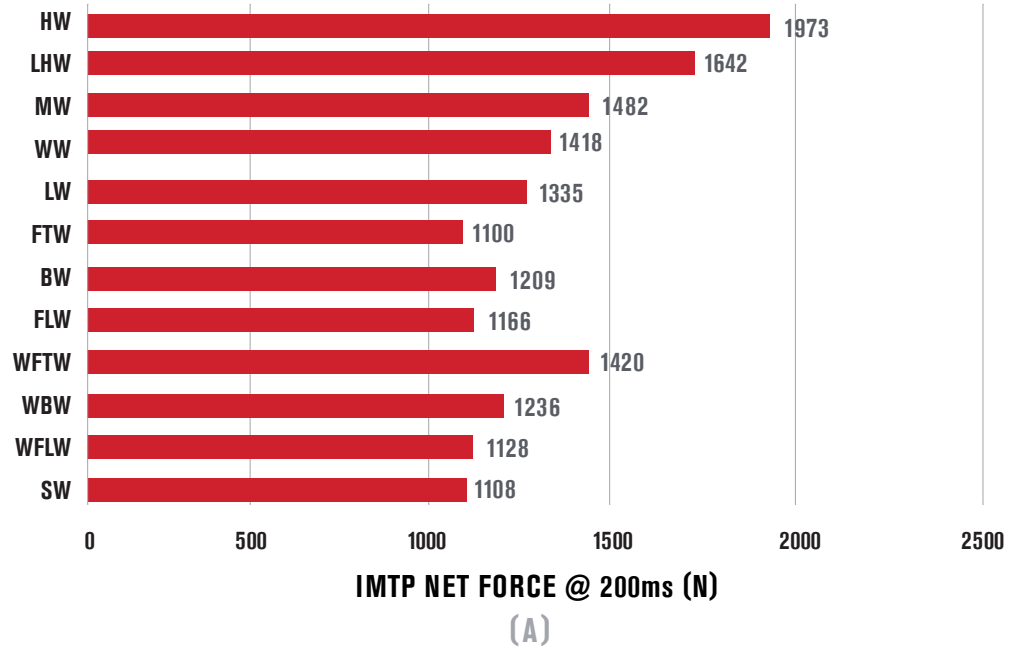
WBW		
WORLD CLASS	>	2252
VERY GOOD	2088	2251
GOOD	1965	2087
FAIR	1719	1964
POOR	1596	1718
VERY POOR	1432	1595
BAD	<	1431

WFTW		
WORLD CLASS	>	2092
VERY GOOD	1965	2091
GOOD	1869	1964
FAIR	1679	1868
POOR	1583	1678
VERY POOR	1456	1582
BAD	<	1455

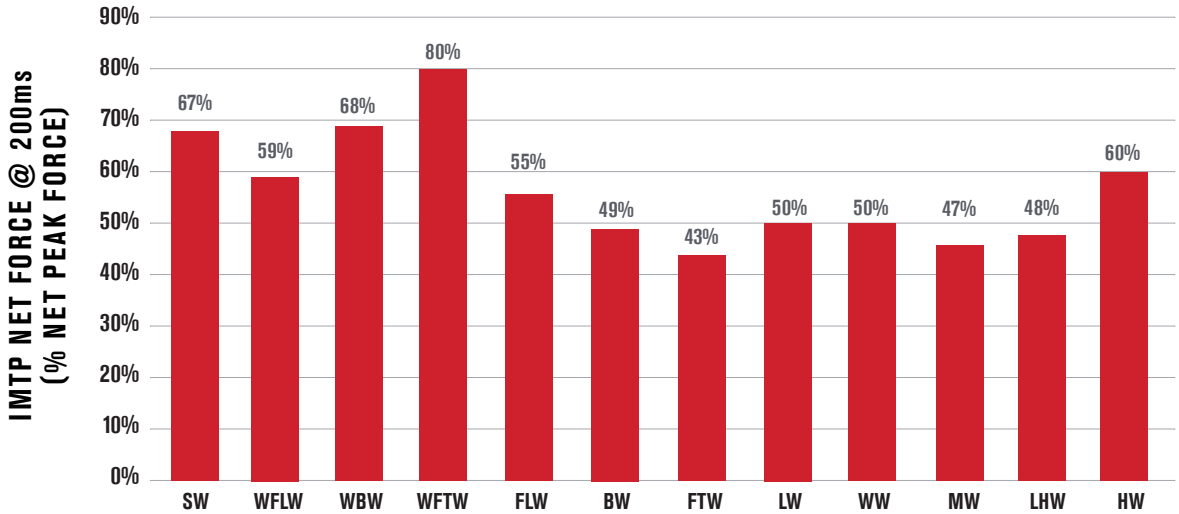
While maximal force capacity is a metric of interest, often in MMA any force output is constrained by the time in which a force must be achieved. For example, if an athlete only has a fifth of a second to achieve the force required to execute a technique against an opponent, then success will be determined not by their maximal force capability but by the amount of force they can generate in that time period. This can be known as rate-of-force development (RFD) and can also be viewed as a relative potential of the individual fighter's maximal force production capacity (i.e., what percentage of maximal force can he or she obtain in a fifth of a second)? To evaluate a proxy for RFD, which is a determinant of success for MMA, with a measure that is comparable to their maximal force production, the net force achieved within 200m/s is measured. Figure 11.6 presents the average net force at 200m/s for all UFC weight classes as a reflection of RFD. Table 11.6 presents the performance benchmarks by weight class for net IMTP net force at 200m/s.

FIGURE 11.6

IMTP AVERAGE NET FORCE AT 200ms (A), AND NET FORCE (B) AT 200ms EXPRESSED AS A % OF MAX



(A)



(B)


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TABLE 11.6

AVERAGE NET FORCE AT 200ms PERFORMANCE BENCHMARKS BY WEIGHT CLASS FOR THE IMTP TEST

FLW		
WORLD CLASS	>	1693
VERY GOOD	1483	1692
GOOD	1325	1482
FAIR	1009	1324
POOR	851	1008
VERY POOR	641	850
BAD	<	640

BW		
WORLD CLASS	>	1628
VERY GOOD	1461	1627
GOOD	1335	1460
FAIR	1085	1334
POOR	959	1084
VERY POOR	792	958
BAD	<	791

FTW		
WORLD CLASS	>	1653
VERY GOOD	1432	1652
GOOD	1267	1431
FAIR	935	1266
POOR	770	934
VERY POOR	549	769
BAD	<	548

LW		
WORLD CLASS	>	1822
VERY GOOD	1628	1821
GOOD	1482	1627
FAIR	1190	1481
POOR	1044	1189
VERY POOR	850	1043
BAD	<	849

WW		
WORLD CLASS	>	1915
VERY GOOD	1717	1914
GOOD	1568	1716
FAIR	1270	1567
POOR	1121	1269
VERY POOR	923	1120
BAD	<	922

MW		
WORLD CLASS	>	2133
VERY GOOD	1873	2132
GOOD	1678	1872
FAIR	1288	1677
POOR	1093	1287
VERY POOR	833	1092
BAD	<	832

LHW		
WORLD CLASS	>	2227
VERY GOOD	1993	2226
GOOD	1818	1992
FAIR	1468	1817
POOR	1293	1467
VERY POOR	1059	1292
BAD	<	1058

HW		
WORLD CLASS	>	2830
VERY GOOD	2488	2829
GOOD	2232	2487
FAIR	1717	2230
POOR	1460	1716
VERY POOR	1118	1459
BAD	<	1117

WSW		
WORLD CLASS	>	1579
VERY GOOD	1391	1578
GOOD	1250	1390
FAIR	968	1249
POOR	827	967
VERY POOR	639	826
BAD	<	638

WFLW		
WORLD CLASS	>	1431
VERY GOOD	1310	1430
GOOD	1220	1309
FAIR	1038	1219
POOR	948	1037
VERY POOR	827	947
BAD	<	826

WBW		
WORLD CLASS	>	1589
VERY GOOD	1448	1588
GOOD	1343	1447
FAIR	1131	1342
POOR	1026	1130
VERY POOR	885	1025
BAD	<	884

WFTW		
WORLD CLASS	>	1867
VERY GOOD	1689	1866
GOOD	1555	1688
FAIR	1287	1554
POOR	1153	1286
VERY POOR	975	1152
BAD	<	974

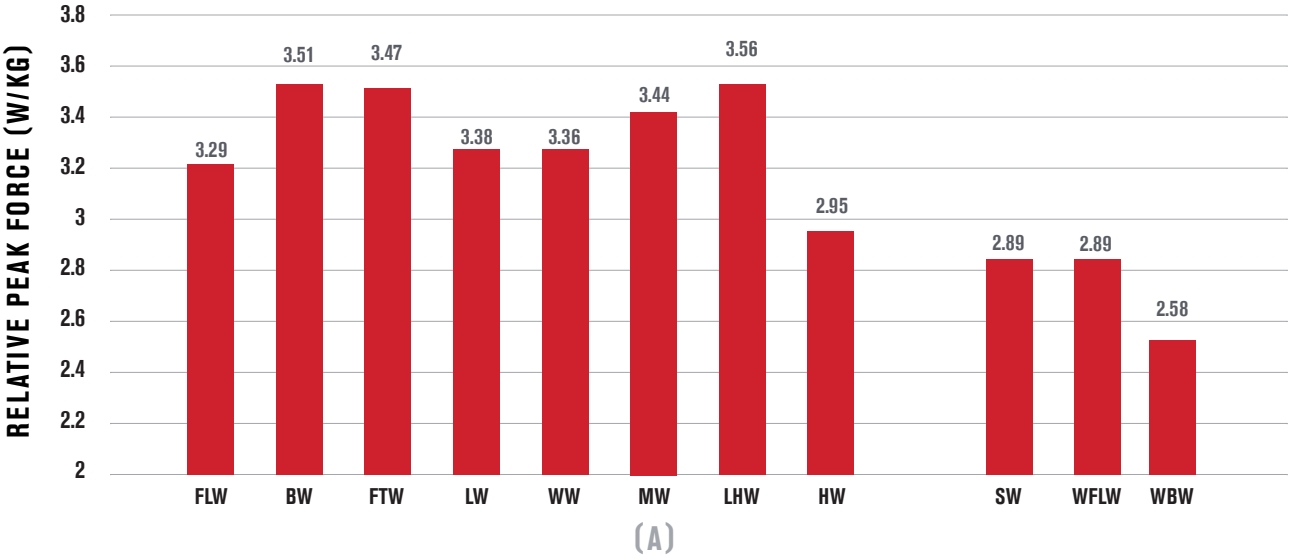
HAND GRIP

MMA involves some techniques that require grip strength. These include manipulating an opponent's body to gain an advantageous position, wrist control in order to defend against attacks and various grips involved in completing a takedown or finishing a submission. Figure 11.7 shows the grip strength average peak force by weight class in UFC fighters using a handheld dynamometer (KForce Grip by Kinvent).

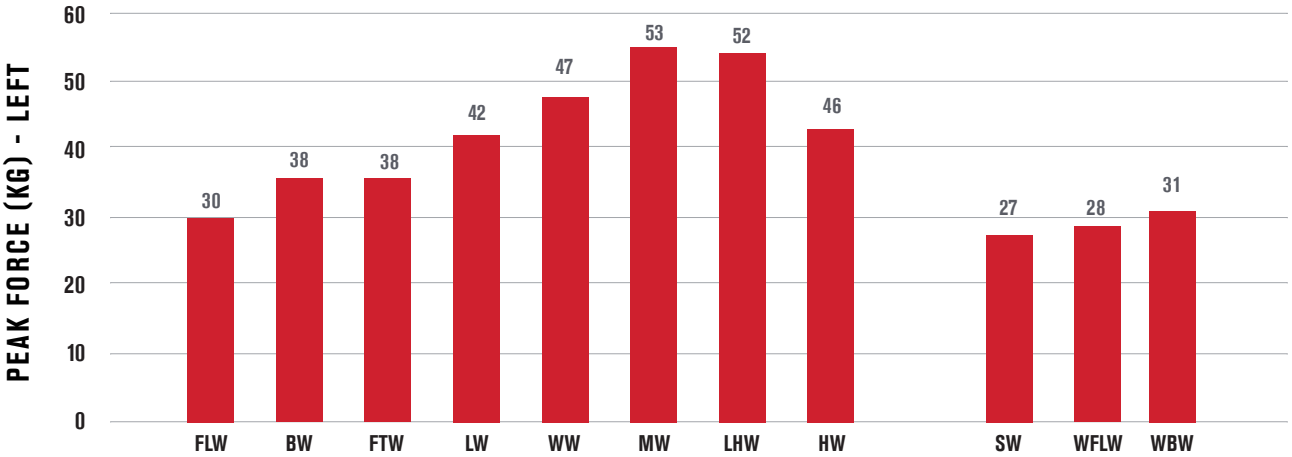
The average net force for 10-seconds is also presented in Figure 11.8. Rarely is instantaneous maximal grip strength a determining factor in success, but instead the ability to sustain grip for a prolonged period of time has a significant influence on a fighter's ability to control an opponent.

FIGURE 11.7

AVERAGE PEAK FORCE FOR RIGHT (A) AND LEFT HAND (B) DURING A DYNAMOMETER GRIP STRENGTH TEST



(A)

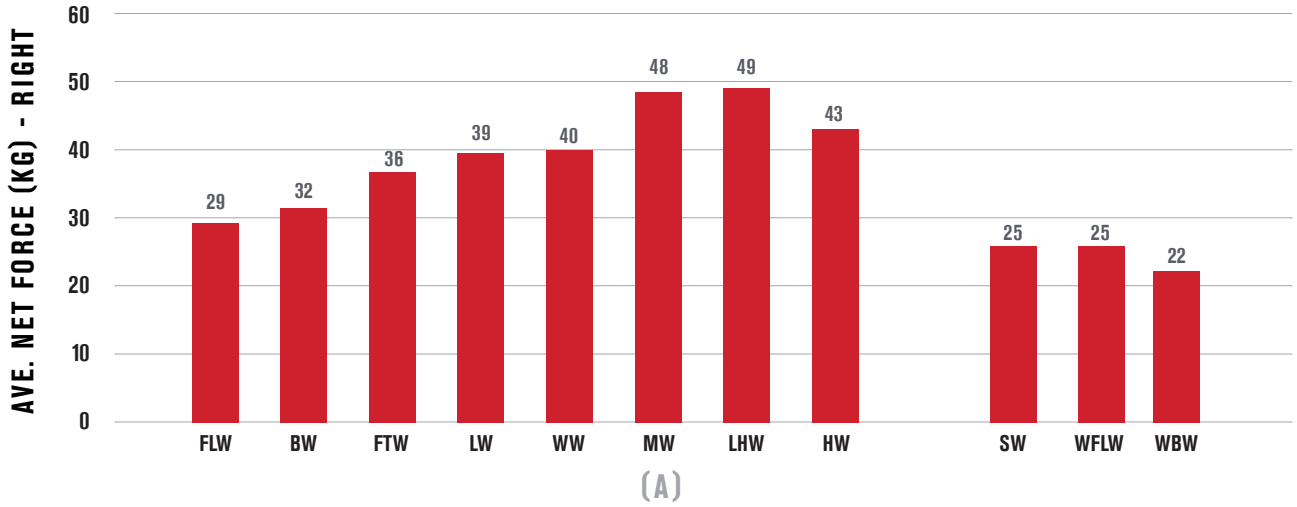


(B)

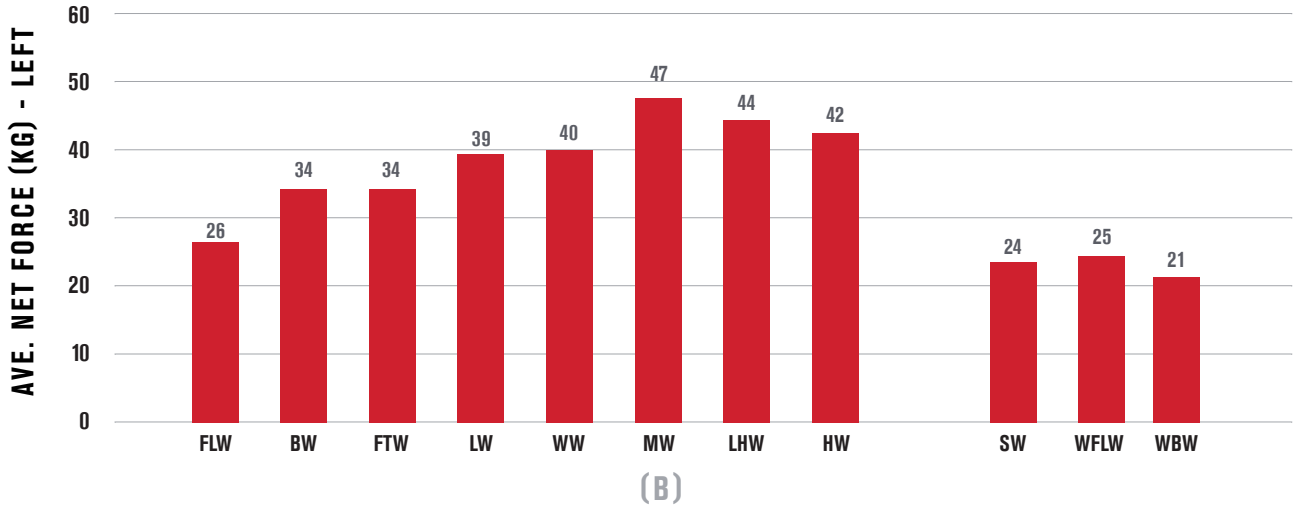


FIGURE 11.8

AVERAGE NET FORCE FOR RIGHT (A) AND LEFT HAND (B) DURING A 10-SECOND MAXIMAL EFFORT DYNAMOMETER GRIP STRENGTH TEST



(A)



(B)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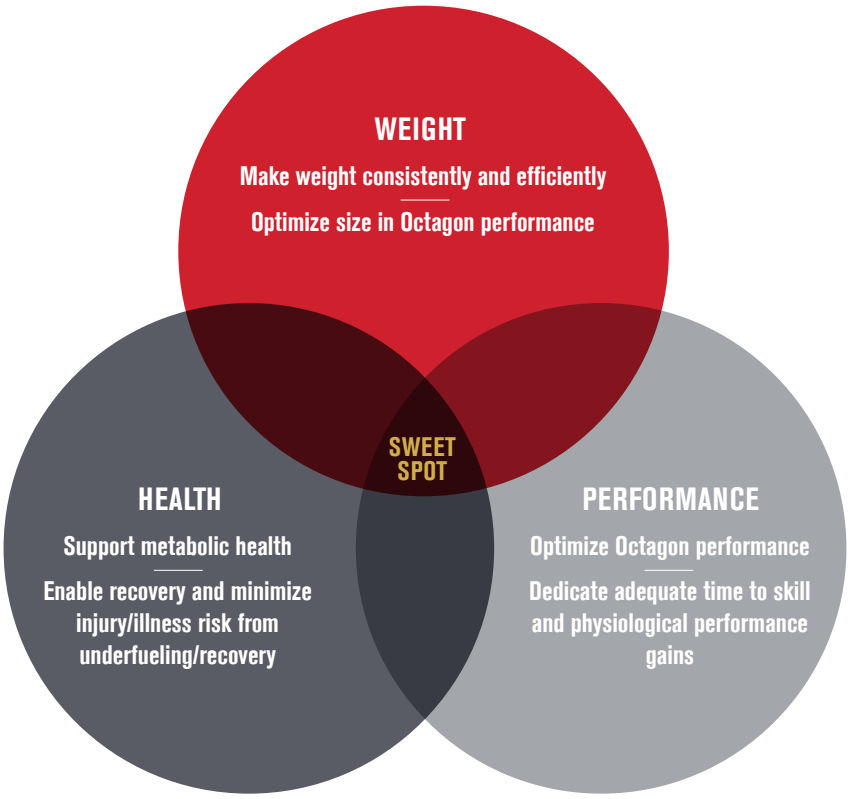
PART 1
SECTION 12

FIGURE 12.1

THE 'SWEET SPOT' FOR WEIGHT-MAKING IN MMA



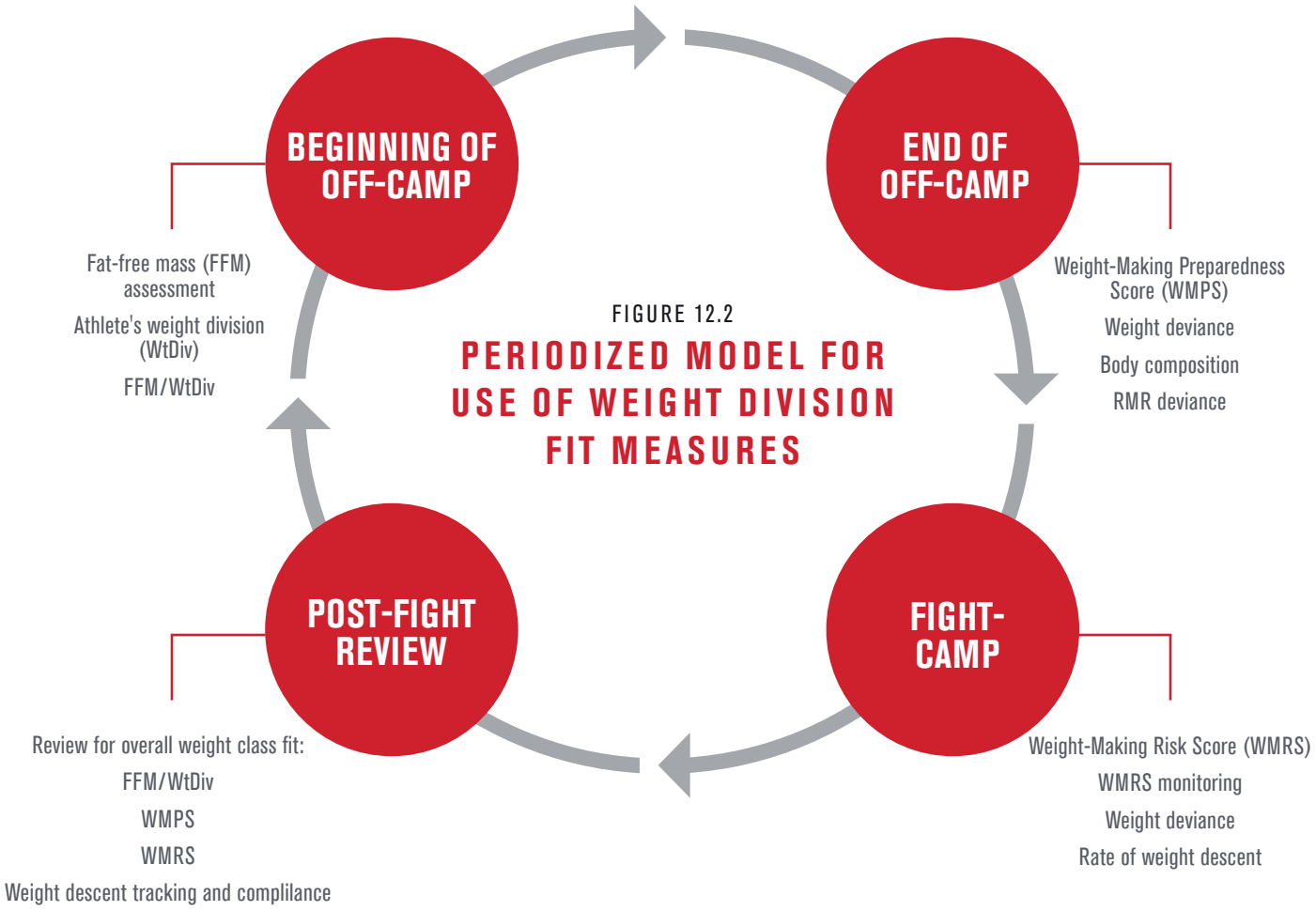
SECTION 12: ATHLETE CONSIDERATIONS: WEIGHT DIVISION FIT

by Clint Wattenberg

MMA athletes often seek to gain a competitive advantage, or reduce perceived competitive disadvantages, by being the larger athlete during competition. Even more so than other weight-class sports, the extended time between weigh-in and competition in MMA, and the physical nature of the sport, drive more extreme weight-making strategies (including longitudinal weight descents and acute weight cutting). While maintaining competitive parity is important for fighters, so are considerations around athlete health and safety, the repeatability of the weight-making process for each fighter and the impact on overall performance (Figure 12.1).

WEIGHT MANAGEMENT CONSIDERATIONS

Various measures can be used to identify UFC fighters' trends within each weight division and for each individual athlete's fit into his or her weight division. Among other factors, a fighter's height and reach should be considered (see Section 8), along with his or her strength and power levels compared to the weight division. However, the main measures that will indicate the best weight division fit for a fighter relates to weight,



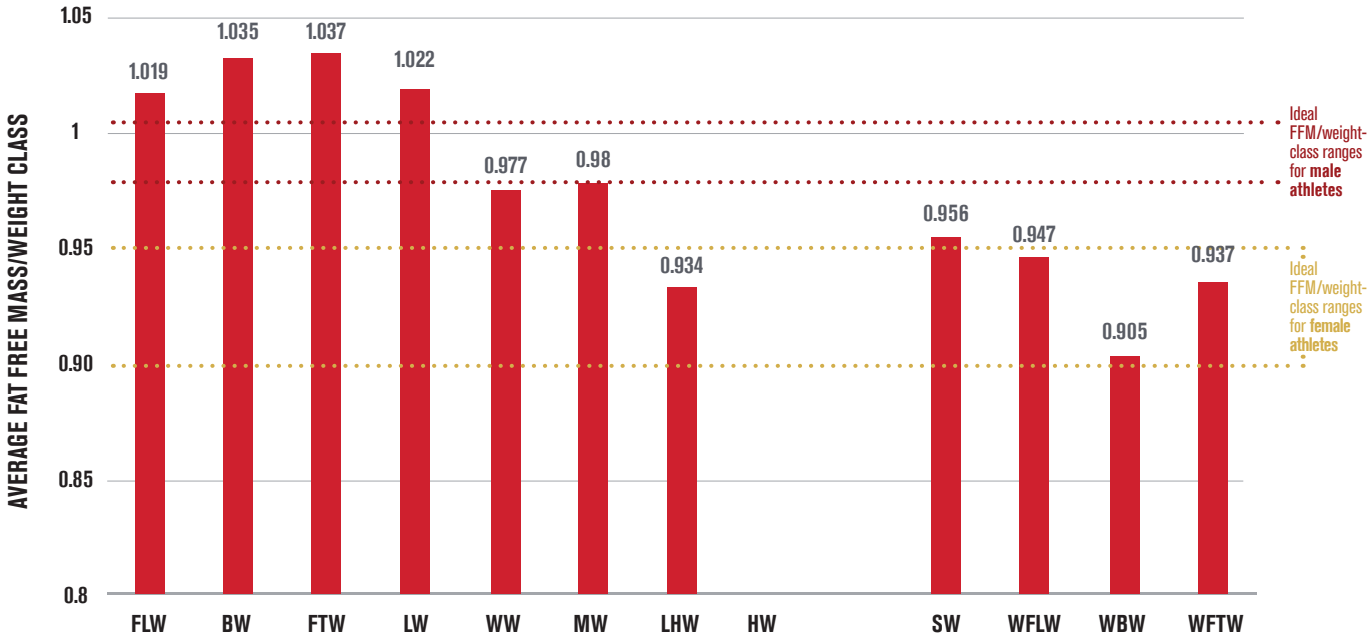
body composition (e.g., body-fat percentage) and metabolic rate. Three measures used by the UFC PI to help better understand a fighter's weight division fit include fat-free mass divided by the weight division (FFM/WtDiv), the Weight-Making Preparedness Score (WMPS) and the Weight-Making Risk Score (WMRS).

The FFM/WtDiv score is crucial to understand for formulating off-camp and fight-camp strategy and goals and is explained later in this section. The WMPS, which is described in more detail in Section 35, takes into account a fighter's body mass compared to his or her target weight pre-fight week, FFM, fat mass and resting metabolic rate. Each of these factors are critical components to complete a weight descent during fight-camp and also direct off-camp tactics around weight, body composition and/or metabolic interventions. Meanwhile, the risk associated with an athlete's weight-making efforts during fight-camp is represented by the WMRS, which is detailed in Section 68. Each of these three measures indicate aspects of athlete weight division fit and can be used for different purposes, particularly in different phases of training to drive decision making. For instance, while the WMRS helps identify and evaluate the upcoming challenge of the longitudinal weight descent process in fight-camp, the FFM/WtDiv and WMPS help determine some of the more nuanced nutritional tactics that can best elicit the desired weight loss. A periodization model for the use of these weight division fit measures is presented in Figure 12.2.



FIGURE 12.3

AVERAGE OF FAT FREE MASS/WEIGHT DIVISION FOR UFC WEIGHT CLASSES



We have found ideal FFM/weight-class ranges for **male athletes to be 0.98-1.02 (· · ·)** and **0.90-0.95 for female athletes (· · ·)**.
This level of mass allows for athletes to be well-sized and competitive in the Octagon without having to excessively reduce muscle mass to make weight before a fight.

FAT-FREE MASS AND WEIGHT DIVISION

As mentioned above, the FFM/WtDiv score has a large influence on off-camp and fight-camp strategy and goals. The amount of fat-free mass (all body mass excluding fat mass) includes lean tissue, bone mass and fluids and indicates an athlete's structural mass (i.e., his or her musculoskeletal system). This mass is less adaptable using traditional weight-descent tactics that target a reduction in body fat during training camps (besides the acute weight loss tactics utilized during fight week that temporarily shifts fluid, fiber and glycogen out of the body for mere hours only to be replaced for the fight). Evaluating an athlete's FFM/WtDiv can provide details on how he or she fits into that division at an absolute level. This makes it an ideal assessment in the beginning of off-camp for evaluating the best weight class fit for a fighter and to identify the need to increase or decrease lean tissue over the medium-longer term (Figure 12.3).The ideal FFM/WtDiv ranges for male athletes seems to be 0.98-1.02 and 0.90-0.95 for female athletes. This level of FFM allows for athletes to be well-sized and competitive in the Octagon without having to excessively reduce muscle mass to make weight before a fight.
Required Equipment: dual x-ray absorptiometry (DXA), bioelectrical impedance analyzer (BIA) or other body composition assessment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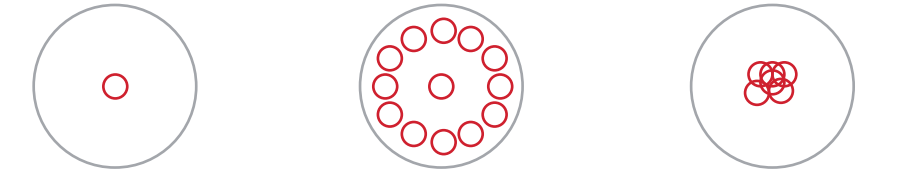
PART 1
SECTION 13

SECTION 13: THE INTERDISCIPLINARY APPROACH: VERTICAL INTEGRATION

By Duncan French

FIGURE 13.1
MULTIDISCIPLINARY VS INTERDISCIPLINARY



INTRADISCIPLINARY (I.E. SINGLE FACTOR)

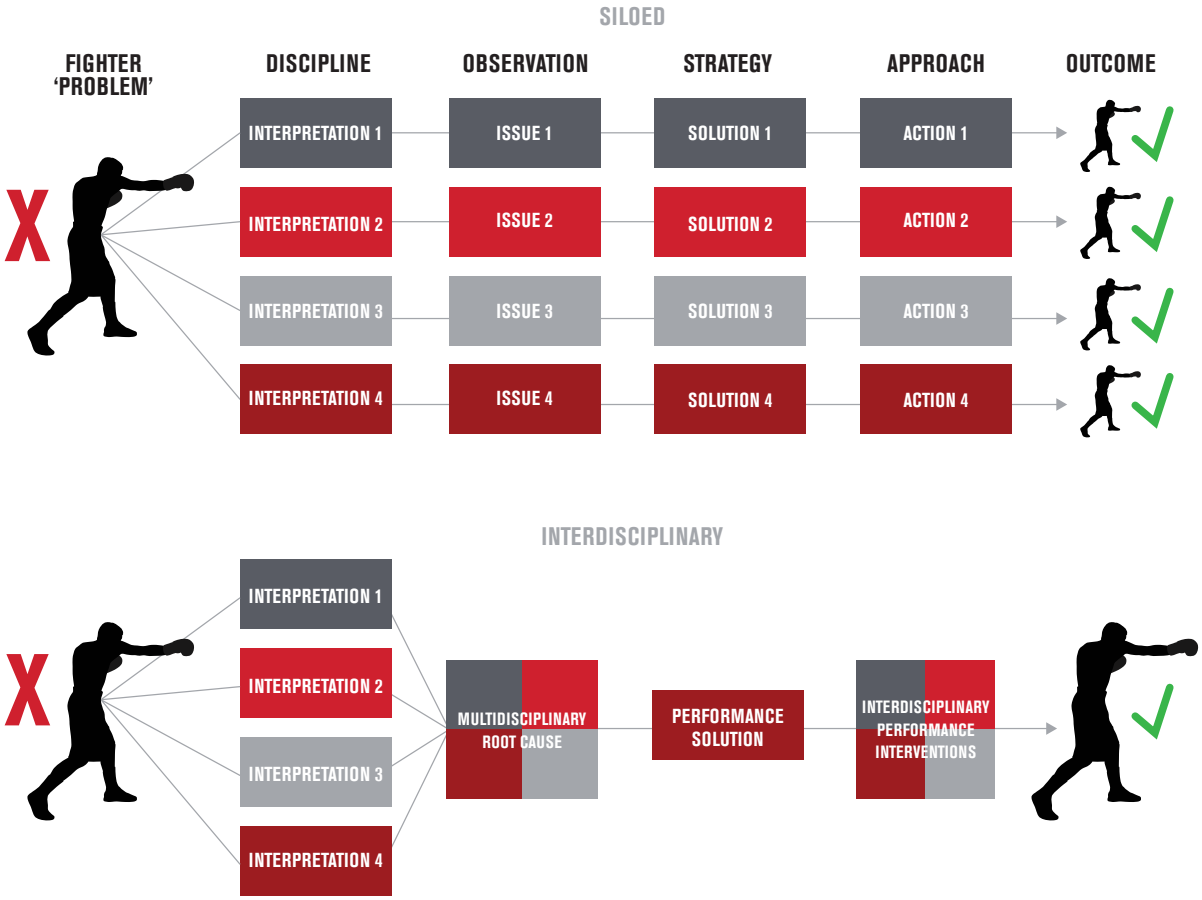
MULTIDISCIPLINARY → **INTERDISCIPLINARY** (I.E. SILOED) (I.E. COLLABORATIVE)

By its nature, MMA has many individual components that need to be considered (i.e., "mixed" martial arts). Each of these components play a critical role in determining success (see Sections 1 and 3). Added to the technical/tactical requirements is the addition of supplementary physical training (i.e., strength and conditioning), managing nutritional strategies off-camp and making weight for fights, the need to receive medical treatment following injury, undertaking recovery and regeneration activities following practice and training, and of course, necessary lifestyle tasks (e.g., grocery shopping, finding time for family, running errands). The interaction of all these different technical, tactical, physical, physiological, medical and psychological components makes the performance landscape for MMA fighters highly complex.

When considering the respective specialists or experts that support an MMA fighter, it is common for athletes to utilize some, if not all, of the following technical and non-technical services: a head MMA coach, striking coach, wrestling and/or grappling coaches, a strength and conditioning coach, physical therapists, a dietitian, a psychologist and any number of additional allied service providers. While some gyms are well-supported, it is rare that all these coaches, therapists and performance specialists are located in the same gym or facility—let alone that they have a comprehensive understanding of what each of the others is doing with regards to the fighter. Instead, it is more common that they are located in different venues throughout a city (discussed in Section 25) and likely have sporadic interaction at best. Although there are multiple disciplines (i.e., multidisciplinary), they rarely interact at an effective level (Figure 13.1). The consequence of this disconnect is that training sessions, treatments or any other activity may not necessarily be complementary to another and the lack of synergy between coaches, therapists and performance specialists is a significant under performance and/or overtraining risk for the athlete (i.e., the athlete gets pulled in too many different directions that don't necessarily account for one another). It is not uncommon for technical and non-technical services working with the same fighter to operate in silos, largely prioritizing their own agenda with an athlete while neglecting to account for the physical or mental exertion the athlete is putting in elsewhere.

FIGURE 13.2

SILOED VS INTERDISCIPLINARY APPROACHES TO PROBLEM SOLVING FOR MMA



When athlete preparation is looked upon through the lens of individual professionals, a singular strategy to managing the athlete remains within the domain of each technical discipline (e.g., an MMA coach drilling specific skills, a therapist managing return to sport or a dietitian striving to improve body composition). The consequence of such a siloed approach is that technical areas end up working on the same performance issues simultaneously in a parallel fashion and independent of one another. Indeed, each expert seeks to find his or her own solution or approach to athlete development, largely due to professional biases, and often things get considered in isolation as that seems necessary within the fast-paced environment of fighter preparation (Figure 13.2). As a result, these discipline-specific silos create greater problems (e.g., overtraining due to poorly managed workloads) and certainly increase the risk of poor performance (Figure 13.2). This approach also misses the benefits of a combination of multiple factors working at the same time (i.e. interdisciplinary; see figure 13.2) to best influence performance enhancement. Examples of this include medical services engaging with MMA coaches during the management of a fighter's knee rehabilitation or dietitians and strength and conditioning coaches collaborating to improve an athlete's body composition.



Adopting a more holistic interdisciplinary approach involves placing the athlete at the center of all considerations for technical and non-technical disciplines. This interdisciplinary approach requires more effort to communicate and to seek collaboration, but it has a greater benefit for a fighter both in the intermediate and the longer term (e.g., MMA and strength coaches not doubling up on high-intensity training sessions, thus mitigating fatigue levels; striking coaches not excessively drilling leg kicks while a therapist is working to rehabilitate a knee injury).

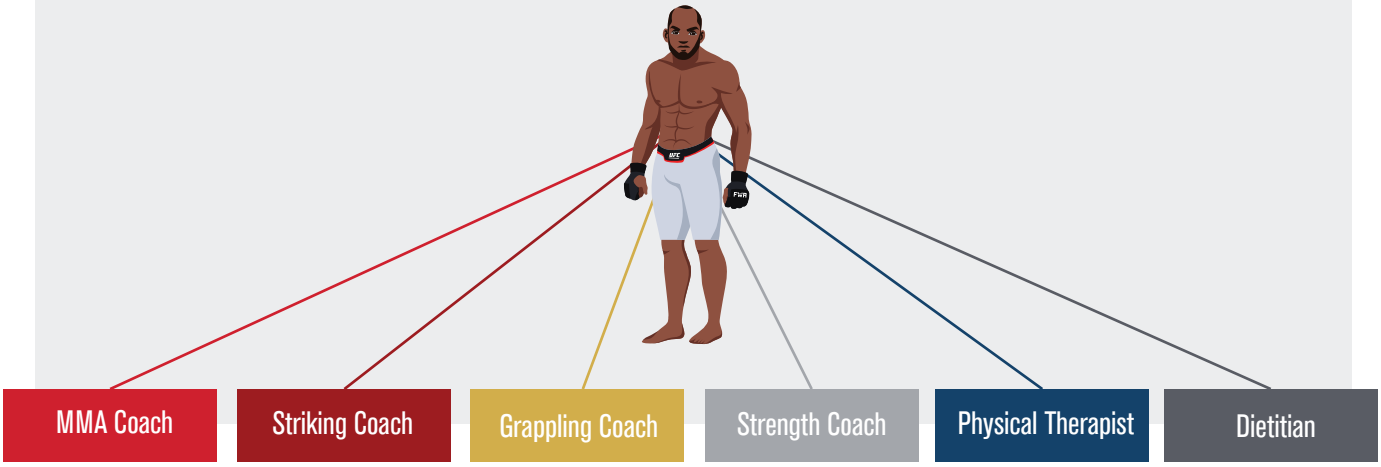
As we evaluate MMA and its various components, it becomes more and more apparent that the interplay between technical/tactical and physical/physiological components is symbiotic. It is impossible to identify where the value of one component starts and another ends. Instead, to truly maximize performance potential, all components of athlete support must be considered holistically as individual cogs that play a critical role as part of a larger machine. Only then can the interplay of technical and non-technical disciplines (i.e. interdisciplinary) be viewed as the most effective way to maximize competitive performance, manage training loads, promote rehabilitation and/or expedite recovery and regeneration.

Horizontal integration of technical and non-technical services and strategies is the norm, and it is common for silos to the detriment of the athlete. In comparison, a vertical integration brings all the respective technical and non-technical services together in a coordinated fashion, allowing for better awareness of what each discipline is doing and providing a much better opportunity for the unified alignment of all disciplines toward a common outcome. Instead of working independently or horizontally, the vertical alignment of all services in an athlete's extended "team" provides the ability to gain greater control over all the constituent parts, promote better interaction and understanding, reduce the risk of silos and drive a coordinated approach to success.

The vertical integration of technical and non-technical services represents an interdisciplinary method of working that maximizes the potential for all services in an athlete's "team" to optimize impact. By having all services closely aligned, training loads can be managed more effectively to ensure excessive overload from multiple training sessions is mitigated, rehabilitation can be better coordinated through the actions of all disciplines and the simple management of schedules and routines can be optimized to ensure the athlete isn't overly committed and has designated planned rest times. The infographic that follows presents a schematic overview of the value of adopting vertical integration of interdisciplinary services, largely due to the highly complex nature of MMA.

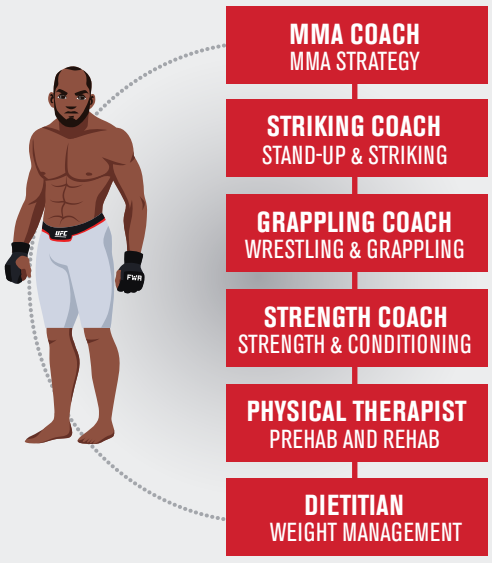
HORIZONTAL ALIGNMENT

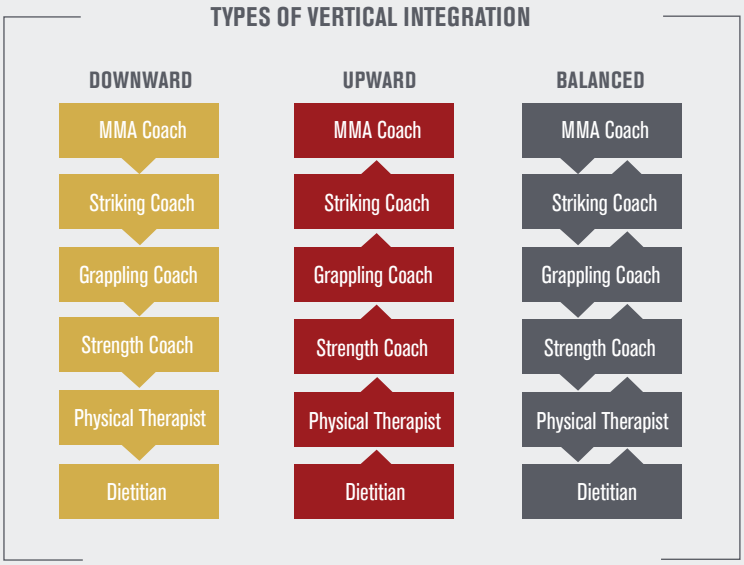
Horizontal alignment shows individual factors operating in silos, largely focusing only on their own technical priorities.



VERTICAL INTEGRATION

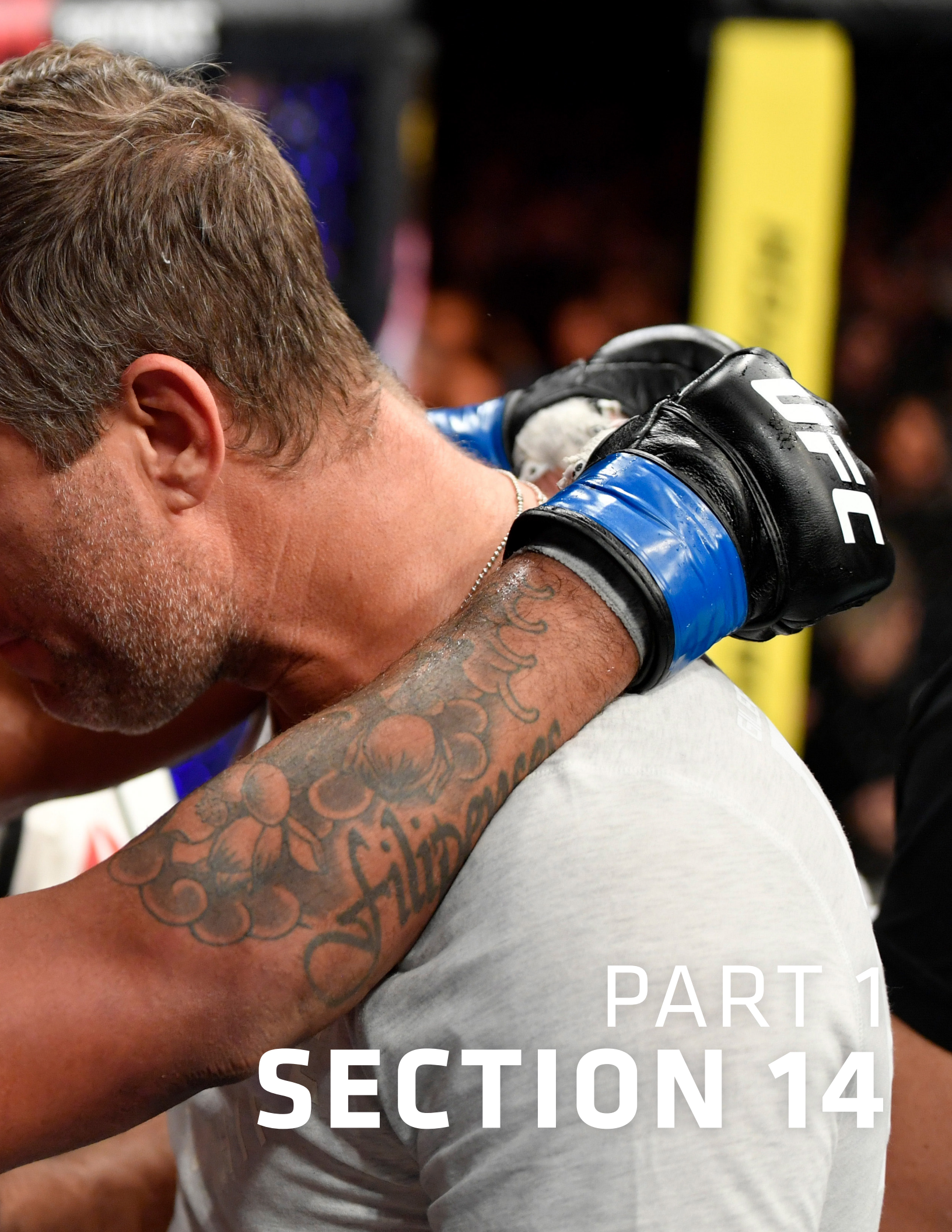
Vertical integration promotes alignment of individual technical strategies. It needs to include all components to be optimal.





MMA fighters are required to manage many individual components, each of which plays a critical part in their training, preparation and development (e.g., MMA, wrestling practice, strength and conditioning, physical therapy). When each of these factors operates in silo, there is increased risk of underperformance, overtraining and/or injury. To promote the optimal impact, all components must operate in an interdisciplinary team, where open communication, workload management and strategic alignment is prioritized. The Vertical Integration of technical and non-technical services represents a strategic approach to integrating all factors that influence performance.





PART 1

SECTION 14



SECTION 14: SYSTEMS-BASED TRAINING THEORY IN MMA

By Joseph Coyne and Dean Amasinger

Systems-based training theory was developed as a way to integrate multiple training factors together in an efficient and effective way in order to optimize athlete preparation. In the case of MMA, there are two major training factors that need to be considered for this to occur: i) technical training and ii) non-technical training. Both these factors contain smaller categories that also need to be intimately managed and effectively integrated into a systems-based holistic approach to training. For example, both striking and fence wrestling can be considered categories of technical training, whereas the development of strength, power and flexibility are categories of non-technical training.

The integration of these categories within the different training phases, especially with respect to technical training, is essential in order to develop an MMA fighter as a true "mixed martial artist," not just a "striker" or "grappler." Intra-coordination of categories within microcycles (i.e., within a training week) and inter-coordination of categories between microcycles (i.e., between training weeks) allows synergy of multiple complementary categories of technical training. This underpins the martial art of MMA and reinforces the integrated approach within micro and mesocycles of training. The emphasis of those categories within technical training and the separation of individual martial arts or technical categories depends on the phase of camp and the individual needs highlighted from the technical evaluation.

Both the technical and non-technical training components should have a structured curriculum that guides athletes through various developmental strategies based on their technical and non-technical evaluation or assessments, with consideration given to whether an athlete is off-camp or in fight-camp. The underlying principle that directs both

TABLE 14.1

EXAMPLE SINGLE-LEG SKILL ACQUISITION FOCUS DURING THE SPECIFIC PREPARATION PHASE WITH TECHNICAL AND TACTICAL EMPHASIS OVER A THREE-WEEK TRAINING CYCLE FOR AN MMA ATHLETE

WEEK	SESSION FOCUS I	SESSION EMPHASIS	SESSION FOCUS II	SESSION EMPHASIS	SESSION FOCUS III	SESSION EMPHASIS
I	Single leg	Technical	Single leg to body lock/clinch Single to double leg	Technical	Traps/setups to single leg	Tactical
II	Double Leg	Technical	Double leg to single leg Double leg to body lock/clinch	Technical	Traps/setups to single leg	Tactical
III	Body lock takedown Body lock to singles Body lock to knee tap	Technical	Traps/setus to body lock	Tactical		

technical and non-technical training development is the relevance to MMA or the perceived transfer of a technique or drill to competition. With regards to technical training, it will have both technical (e.g., how to perform a skill) and tactical (e.g., when to perform the skill in competition) requirements. Even if individual martial arts are trained separately, an understanding of how a particular technique is relevant to MMA should be central to the training focus.

Once a technical evaluation of a fighter has been conducted (highlighted in Section 3) and performance assessments are carried out (highlighted in Section 4), a structure for the longitudinal development of an athlete can be established using the "system" as framework. Each part of the technical and non-technical training categories are bound by certain constraints and compromises (e.g., phase of training, balance of categories and load distribution considerations). Furthermore, they can also be influenced by specific strategy consideration (e.g., "do I need to focus on fence wrestling or strength levels considering my opponent's strengths and weaknesses?"). However, in the case of MMA, this approach is both interrelated and interdependent, whereby changing one part of the system may affect other parts of the system. For example, a specific focus on lower body strength development in non-technical training may present a complementary improvement in stand-up ability during fence wrestling. Any system that is developed should also be adaptable and upgrade over time. In this case, it may mean that as new competition techniques emerge and are proving to be successful, the development framework can adapt and incorporate these new techniques.

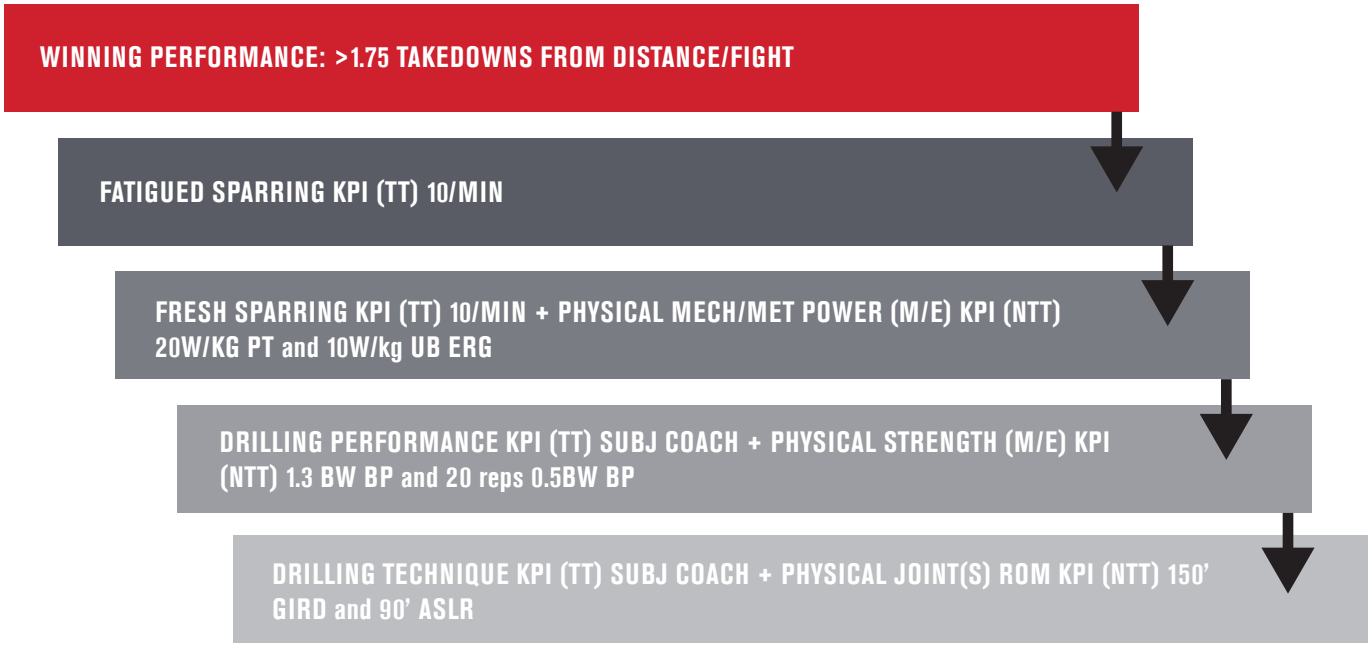
To apply training concepts into a systems-based training approach, template models should be created that can be adapted and flexed based on different scenarios. As previously highlighted, these may be due to certain unforeseen logistical constraints, like a short-notice fight-camp. Table 14.1 gives an example of a skill-acquisition training block template model with a single-leg takedown focus that considers other grappling techniques—along with corresponding technical and tactical weightings.



With knowledge and insight of "what it takes to win" (WITTW), established by interrogating fight characteristics and trends (see Section 1), it becomes possible to then reverse engineer the essential determinants that underpin success and sequentially create a standardized set of performance markers. By having an understanding of WITTW statistically, MMA coaches can then combine this with their subjective interpretation of how fights can be won, and essential performance markers can be defined according to an athlete's strengths and weaknesses in the technical training curriculum, as well as an understanding of their physical attributes (e.g., aerobic capacity). These performance markers can be revised throughout different training phases; particularly once a new opponent has been booked and his or her fighting style is known. Although there are many nuances to any fight preparation, an example of applying a systems-based model in which training is reverse engineered from competition for an athlete that wants to emphasize "takedowns from distance" as a key performance indicator (KPI) is provided in Figure 14.1.

FIGURE 14.1

AN EXAMPLE SYSTEMS-BASED APPROACH TO TECHNICAL (TT) AND NON-TECHNICAL TRAINING (NTT) DEVELOPMENT BASED ON WRESTLING TRENDS AND CHARACTERISTICS FOUND IN UFC COMPETITION



In the example show in Figure 14.1, the fighter and coach have a strategic sequence in which both technical training (TT) and non-technical training (NTT) development begin during the off-camp phase:

Off-Camp: Drilling technique KPIs (TT) and range of motion (ROM) KPIs (NTT).
For technical training, before repeated performance of any MMA technique or drill is performed under fatigue, it must be mastered when fresh (i.e., when an athlete can repeatedly perform a technique with high quality and accuracy). Likewise, before a technique is performed in drills, understanding if the athlete has the necessary biomechanical capabilities (i.e., ROM) to perform the technique is required. For example, to finish a single-leg after being sprawled to the ground, does the athlete have adequate shoulder ROM to perform this? Or, for a low double-leg, does the athlete have adequate hip and ankle ROM to keep appropriate posture to be strong into contact?

Off-Camp: Repeated drilling of performance KPIs (TT) with the addition of physical strength KPIs (NTT).
Before techniques can be performed in sparring, an athlete should be able to perform the techniques repeatedly under fatigue in drilling situations. In the NTT stream, adequate maximal strength and strength endurance levels specific to striking are recommended before progressing to focusing on power production.

Off-Camp / Fight-Camp: Fresh sparring KPIs (TT) and maximal power KPIs (NTT).
Before repeated execution of the technique can be achieved in sparring, the athlete will need to be able to i) produce the desired performance output when fresh (e.g., in the first one to two rounds of sparring or other shorter live goes in a training session) and ii) have the prerequisite NTT mechanical power and power endurance specific to wrestling.

Fight-Camp: Repeated sparring KPI (TT).
For an MMA athlete to achieve any competition KPI, they must first achieve this KPI during repeated sparring bouts in a fatigued state (e.g., consistently maintain takedowns per round above the desired KPI in all a training sessions' sparring rounds). There may also need to be a planned over-shoot to the KPI (e.g., 10% greater than the competition KPI) that counteracts competition pressures such as weight cutting and performance anxiety.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PART 1
SECTION 15



SECTION 15: PERIODIZATION FOR MMA

By Dean Amasinger, Bo Sandoval, Gavin Pratt and Felix Falkenberg

Perhaps more so than any other sport, periodization and planning in MMA needs to be flexible, largely due to the unpredictable nature of fight bookings and the lack of a clearly defined competition schedule. Factors outside of the athlete and coach control, such as matchmaking, rankings and opponents pulling out, influence when and where fights may take place. The historical trend in MMA has been for a fight-camps to last between eight to 12 weeks, with a relatively unstructured approach to the off-camp phase. A fight-camp would traditionally focus on three primary factors: i) weight descent, ii) conditioning, and iii) technical-tactical preparation. In these cases where an athlete has neglected their weight in off-camp, conditioning and weight management would have to become the priority of the fight-camp and will negatively impact any technical-tactical development from fight to fight. The increase in non-technical conditioning, alongside the chronic calorie deficits needed for a weight descent, would also increase injury risk. Consequently, the traditional combination in fight-camp would likely result a sub-optimal performance.

Instead of focusing on a fight-camp to fight-camp approach, the UFC PI promotes a "52-week fight-camp" philosophy. While this term is somewhat tongue-in-cheek, it refers to the need for a year-around approach to athlete development—not an approach in which athletes try to achieve everything needed during the eight to 12 weeks immediately preceding a scheduled fight. In its simplest terms, MMA periodization is broken up into two major phases: **off-camp** and **fight-camp**. The 52-week approach seeks to develop multiple factors simultaneously using a periodization model that integrates both technical and non-technical training during off-camp and during fight-camp. Indeed, the idea is to build physical characteristics in off-camp that improve both weight management and performance while reducing injury risk and supporting technical training activities that are completed during off-camp. As an athlete transitions into fight-camp, they can then prioritize the technical-tactical development required for their upcoming competition. By adopting a 52-week fight-camp mentality, athletes can largely mitigate the impact of the unpredictable nature of MMA fight scheduling.

"PLAN THE WORK. WORK THE PLAN."

OFF-CAMP PHASE

The off-camp phase is the time when no bout is scheduled or booked for a fighter. While the off-camp phase is generally around 3 to 12 weeks for most active fighters, this period may last indefinitely depending on the booking of a future fight. The off-camp phase can be separated into two phases: i) general preparation and

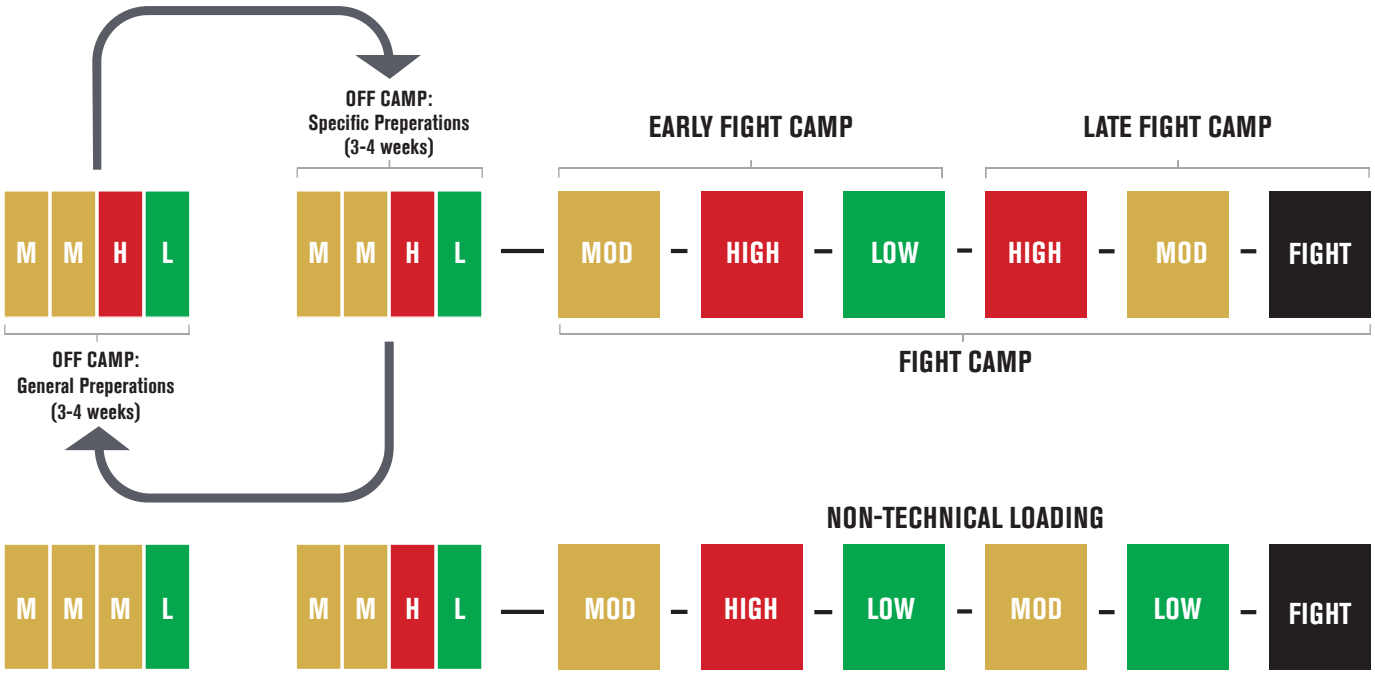


FIGURE 15.1

An example periodization structure for technical and non-technical training in MMA. Low training weeks are colored green; moderate training weeks are gold and high training weeks are red.

ii) specific preparation. Fighters will normally progress through these phases sequentially or cycle between them while in the off-camp phase. For example, during an off-camp period with an undefined length (due to lack of fight date), athletes might alternate between three to four weeks of general preparation and three to four weeks of specific preparation. Once a date for a bout is set, the athlete and coach can then decide the most appropriate time to move into their fight-camp (i.e., pre-competition phase). In line with the 52-week fight camp philosophy in which an athlete has a much more structured and productive off-camp, a fight-camp can potentially be reduced to six to eight weeks. The fight-camp can also be separated into phases, normally i) early fight-camp and ii) late fight-camp.

Figure 15.1 illustrates an example technical and non-technical periodization structure for MMA. In this example, an athlete follows an undulating weekly progression during off-camp. This is represented by a Moderate-Moderate-High-Low loading cycle over four weeks, with the potential to be adapted to three-week cycles with a Moderate-High-Low loading cycle. Using different terminology, this can also be thought of as an Introduction-Accumulation-Peak-Deload approach over four weeks or an Accumulation-Peak-Deload for a three-week cycle. This undulating weekly cycle allows for positive adaptations (e.g., increased technical skill or fitness) in fighters while hopefully balancing the risk of any negative adaptations (e.g., illness or injury). The choice between a three- or four-week cycle can depend on several factors, including booking of potential fights and the athlete's reaction to longer or shorter training cycles. For example, an athlete that has a history of injuries or is more prone to illness may benefit from shorter training cycles with more frequent low-training or deload weeks.



COACHES TALK

The idea behind periodization is to plan and coordinate training in such a way as to maximize technical-tactical development as well as performance standards, while reducing injury and overtraining risk. This approach is taken so that hard and easy training sessions/days can be appropriately distributed with rest and recovery scheduled, so that days off or half days come before the athlete is forced to take them. Also, some of the mental traits of an athlete, such as competitiveness and discipline, are just like any physical characteristic that have a genetic ceiling. However, they also act like wells that are drawn from every time they are used. The idea is to have a periodized and planned program that promotes filling that well and making it deeper, rather than drawing from it too much and limiting the potential of an athlete.

FIGHT-CAMP PHASE

In the six-week fight-camp example shown in Figure 15.1, the periodization follows a Moderate-High-Low or Accumulation-Peak-Deload structure for early fight-camp and a High-Moderate-Low or Peak-Taper-Taper structure for late fight-camp. Early fight-camp is focused on laying the foundations of technical work and the physiological adaptions of which will be required in competition. The late fight-camp sees a taper and reduction of training volume, and in some cases intensity, to allow for peaking on or as close to fight-day as possible. Setting up late fight-camp to have two weeks of reduced training volume and intensity, rather than a high-training load up until the fight, means it is more likely that the positive adaptations from training will be able to be expressed by the fighter, rather than seen up to one to two weeks after the fight due to a lack of rest (see Section 70).

The intensity, frequency and volume of training can be periodized and manipulated in a number of ways during off-camp and fight-camp. Examples include i) training session duration, ii) the ratio of live work to technical drilling, iii) the number of live rounds in technical training or iv) percentage of 1RM or heart rate in non-technical training. However, the intensity, frequency and volume of training is not the only thing that should be considered when periodizing an athlete's preparation for a fight. With a holistic approach to fight preparation, other variables such as coaches' feedback, the level of athlete choice in training, recovery modalities, technical-tactical focuses and strengths-weaknesses emphases should all be manipulated in a complimentary manner to maximize the training environment and optimally position the athlete for competition.

Figure 15.2 shows an example off-camp and fight-camp cycle for a UFC Academy athlete. The figure shows the different phases of preparation and highlights the coaches' planned technical (TT) and non-technical training (NTT) distribution, including the distribution of technical drilling, live MMA work (including the number of live rounds), strength training and energy system training.

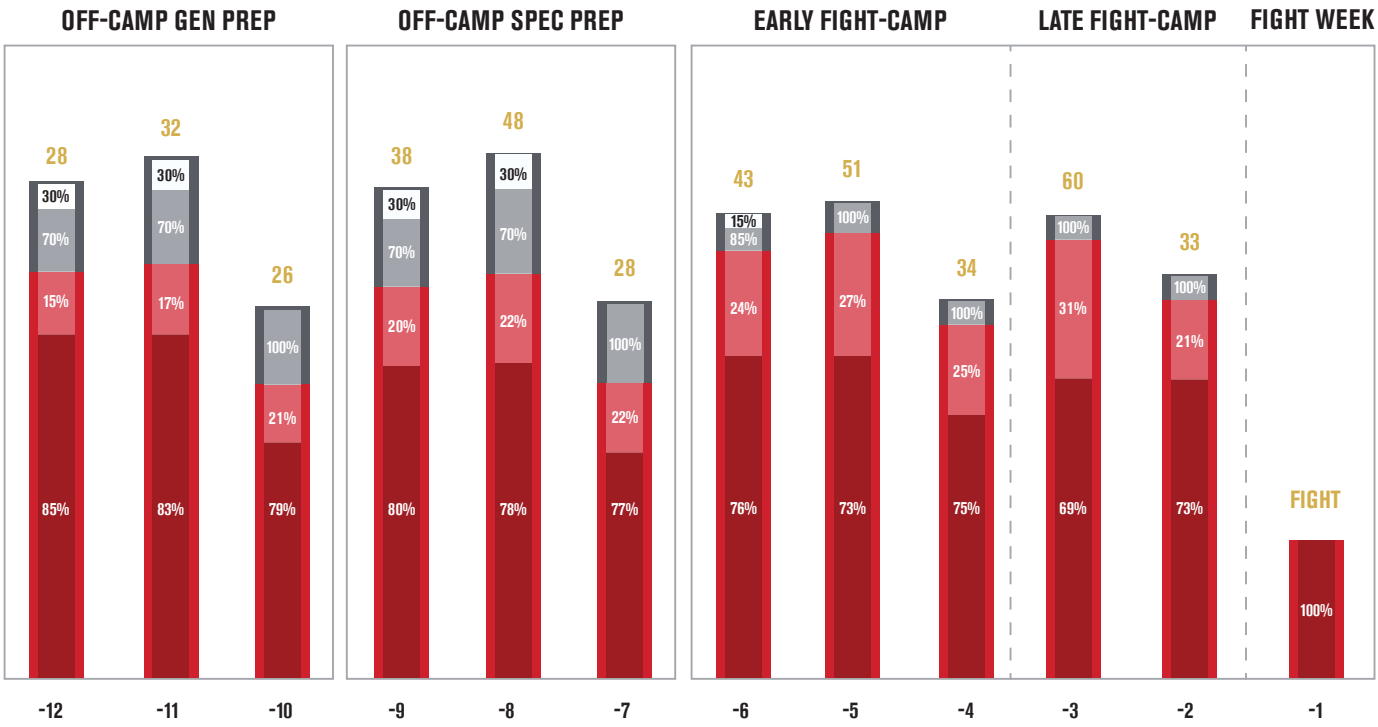


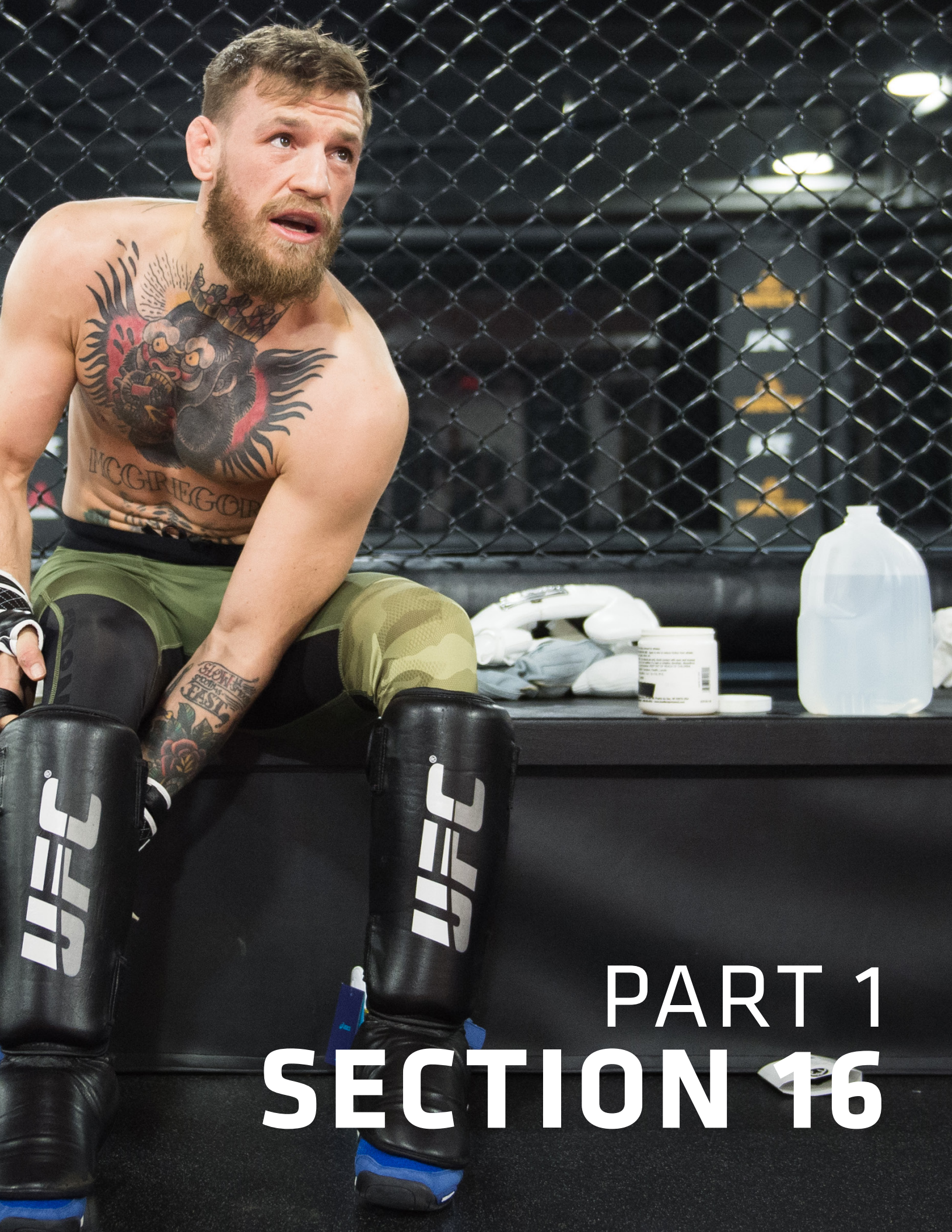
FIGURE 15.2

Red bars represent the total load for technical training (% distribution technical drilling (darker red) vs. % distribution live goes (lighter red)); Grey bars represent the total load for non-technical training (% distribution strength training (darker grey) vs. % distribution energy system training (white)); Number of total live rounds per week (gold).

REAL-WORLD APPLICATION OF PERIODIZATION

Having centralized, interdisciplinary services where technical coaching and all performance services are performed at the same facility is not common, with the exception of facilities such as the UFC PI or some larger MMA gyms around the world. Instead, most athletes are required to train at multiple venues in order to fulfill their training needs and do not have all their coaches and support staff under one roof. In scenarios such as this, there are a number of logistical issues, such as travel time and availability of coaches, that influence the overall daily schedule of a fighter. Therefore, periodization of their training becomes of the utmost importance. For example, a coach may only see an athlete once a week. Knowing where his or her session fits in respect to other sessions in the day, week and/or cycle will allow the coach to plan the session and technical-tactical emphasis appropriately. Coordination and communication between coaches about training load distribution and technical-tactical emphasis is critical in order to maximize the development of the athlete. A lack of coordination and planning between coaches can lead to avoidable overtraining scenarios, and in some instances, can present an increased injury risk. Preferably, the planning and periodization of training will be coordinated by a head coach or performance director.





PART 1
SECTION 16

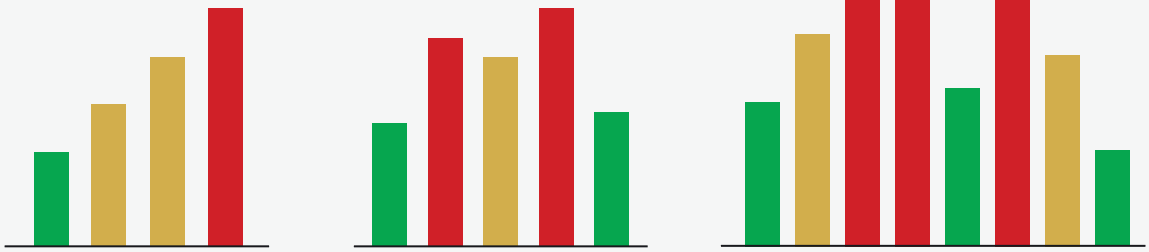


SECTION 16: MANAGING TRAINING DISTRIBUTION

By Duncan French and Matthew Crawley

Athletes adapt to training following periods of overload and then recovery, which allows for adaptations to occur. If there are insufficient or no recovery periods, the athlete's body and mind are unable to adapt to any training stimulus. The distribution of training within a plan is critical to optimize its benefits. Training distribution can happen at many levels, including the phase of training (e.g., off-camp, fight-camp), during mesocycles (e.g., week to week), during microcycles (e.g., during a week) and within an individual training session.

PHASE DISTRIBUTION



GENERAL PREPARATION PHASE - LINEAR

Training increases linearly.

Progressive overload of technical and physical attributes.

SPECIFIC PREPARATION PHASE - UNDULATING

Training undulates allowing for exposure to higher workloads.

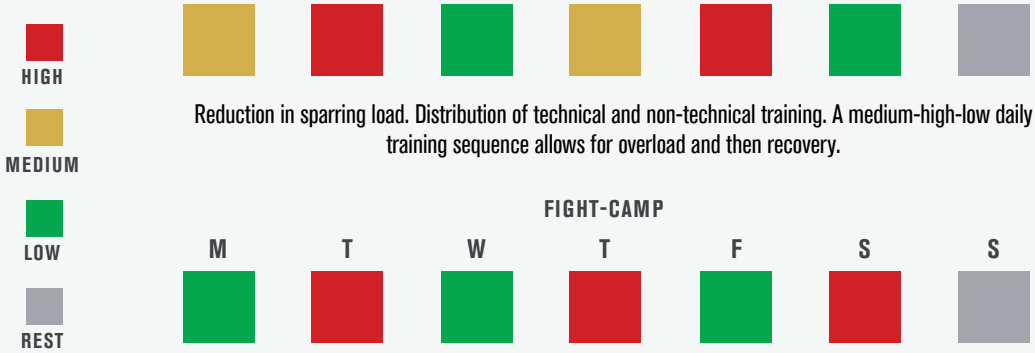
Specific training includes a variety of training techniques.

FIGHT CAMP - PEAK & TAPER

Training is maintained at a high level during fight-camp.

Deload weeks aid regeneration; taper maximizes fight readiness.

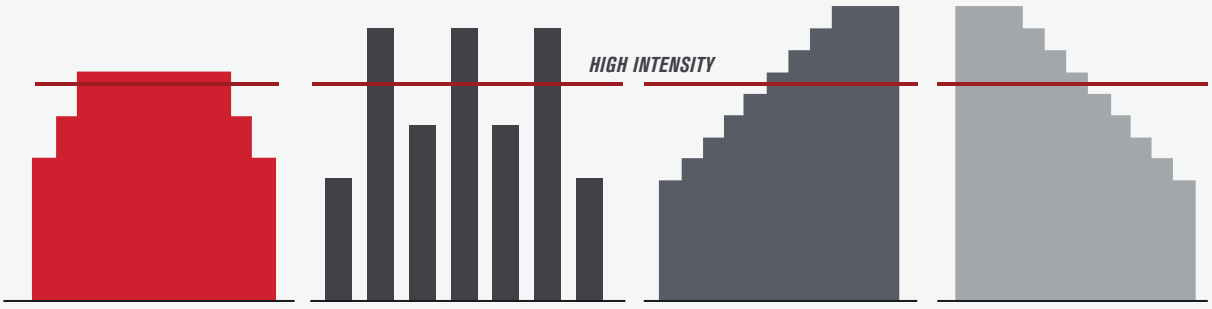
WEEK DISTRIBUTION



Reduction in sparring load. Distribution of technical and non-technical training. A medium-high-low daily training sequence allows for overload and then recovery.

Prioritize technique and sparring. Increased technical and tactical training. Training distribution is polarized with more high-training days a week. Must account for deload day(s).

SESSION DISTRIBUTION



Plateau (e.g., sparring, aerobic conditioning). Training peaks and is maintained.

Intervals (e.g., technical drilling, conditioning).

Undulation allows for optimal work and recovery.

Ascending (e.g., skill development). Training begins low to allow for learning, then increases.

Descending (e.g., metabolic training). Starts high to shock the system, then decreases.





PART 1

SECTION 17

SECTION 17: CONCURRENT TECHNICAL AND NON-TECHNICAL TRAINING CONSIDERATIONS

By Joseph Coyne and Duncan French

The overarching technical and non-technical programming strategy is influenced by three concurrent interactions: i) the technical-non-technical interaction (e.g., "How do I set up conditioning around a grappling session?"), ii) the interaction between technical components (e.g., "How do I set up a striking session so that it doesn't influence my grappling session?") and iii) the interaction between non-technical components (e.g., "How do I set up conditioning around a maximal strength session?"). These interactions then need to be considered in light of the technical (e.g., grappling skill competency) and non-technical (e.g., maximal strength) assessments and the needs analysis of the athlete. Examples of how the needs analysis will affect planning of training around these interactions include:

i) Technical-Non-Technical Interference

An experienced MMA fighter who has an excellent array of technical skills, but poor maximal strength relative to his or her weight division, would normally need to develop maximal strength qualities in order to improve competitive performance. In doing so, they may accept a greater interference effect of non-technical work on technical work (e.g., fatigue or soreness from maximal strength training in a subsequent striking session) than an MMA athlete who needs to develop technical skills.

ii) Interference Between Technical Components

A weak striker may need to devote more time to striking and accept greater interference effects from striking sessions on grappling than would an MMA fighter who has more balanced skills in both areas.

iii) Interference Between Non-Technical Components

An MMA fighter with poor conditioning, but high levels of maximal strength for his or her weight division, may seek to devote more time to energy-systems development and would accept greater interference of conditioning work on maximal strength training than would an athlete who is both conditioned and strong for his or her weight division.

After these interactions are considered, the overall periodisation structure needs to be taken into account in order to maximize desired training adaptations—especially with regard to the technical-non-technical training interaction. Generally, a greater interference of non-technical training on technical training is more acceptable the further from a fight (e.g., in general prep compared to specific prep or off-camp compared to fight-camp). There is also the consideration that technical ability (i.e., fighting skills) will influence competitive performance more than non-technical ability (e.g., level of strength and conditioning). This will normally mean non-technical training is designed and scheduled to minimize interference on technical training, unless there are significant non-technical weaknesses. Technical training will likely be prioritized in most cases. Also, if sparring sessions are the most important sessions of the week for a fighter, coaches may also want to consider minimizing the impact/interference from other technical work.

Different modes of technical training (e.g., drilling, live work) and non-technical training (e.g., alactic work, max strength) and their impact on future training from residual fatigue should always be considered when scheduling training plans. The level of impact from residual fatigue is illustrated in Figure 17.1. In this case, technical and non-technical training activities that are high have the most impact on future training (i.e., they require more recovery time) while training activities that are low have the least impact on future training (i.e., requires less time to recover). These training modes can also be scheduled together (e.g., sparring with max strength) on the same day to achieve an undulation in training load over a week. Meanwhile, having non-technical mechanical power or metabolic alactic work the day before sparring may be used to prime and potentiate athletes for sparring on the following day.

FIGURE 17.1

COMPLEMENTARY TECHNICAL & TACTICAL (TT) & NON-TECHNICAL (NTI) PAIRING AND THEIR EFFECT ON SUBSEQUENT TRAINING DUE TO RESIDUAL FATIGUE



TABLE 17.1

EXAMPLE COMPLEMENTARY OFF-CAMP TRAINING PLAN (WEEK)

DAY	I	II	III	IV	V	VI
AM	MMA WRESTLING	SPAR	BBJ + PADS REMEDIAL + AEROBIC ESD	FENCE WRESTLING	SPAR	BBJ + PADS REMEDIAL + AEROBIC ESD
PM	STRIKING	MMA WRESTLING	OFF	MMA WRESTLING	MAX STRENGTH + LACTIC ESD	OFF
	POWER + ALACTIC ESD	MAX STRENGTH + LACTIC ESD			SPAR REVIEW	
	MOD	HIGH	LOW	MOD	HIGH	LOW

Taking all these factors and training modalities into account, a training plan must be assembled by the coach. As discussed, ideally the non-technical work is complementary to technical training (i.e., has as little interference on technical training as possible). An example of an off-camp training plan that could be considered complementary is presented in Table 17.1. In this plan, there is a clear undulation of training load, where the high days are "really" high and low days are "really" low. This occurs across the week with a moderate, high, low cycle that is repeated twice. The moderate non-technical training on Day 1 (mechanical power and metabolic alactic work) is also strategically placed before the most important session of the week (the first sparring session) with the aim of potentiating this sparring performance. There is also the deliberate inclusion of a low-technical striking session on Day 1 evening to minimize interference and also helping to ensure athletes are not overly fatigued for the subsequent Day 2 sparring session. The low-technical and non-technical work on Day 3, also serves as a regeneration session (e.g., low-intensity and low-biomechanical stress cardiovascular work) in the middle of the week, and should aid in recovery for the latter part of the training week.



Hopefully it has become apparent that MMA has a significant number of skill-related categories, as well as complex physical and physiological attributes that must all be targeted concurrently within training in order to be successful. Longitudinal development of both technical and non-technical components presents a complex programming puzzle that must be managed effectively, or negative consequences can appear (e.g., over-training from poor training management, under-performance in certain technical skills as they haven't been trained sufficiently). Figure 17.1 shows a strategic approach to the distribution of training components within a training microcycle (i.e., one week). The question then becomes how can training support the ongoing development of all factors concurrently across a mesocycle (i.e., one month) or even a macrocycle (i.e., three months between bouts). Adopting an emphasis-based approach to planning represents a valuable way to potentially manage the concurrent needs of the diverse MMA technical and non-technical portfolio (see Figure 17.2).

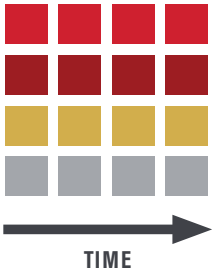
FIGURE 17.2

EMPHASIS-BASED APPROACH TO CONCURRENT TRAINING MANAGEMENT FOR MMA



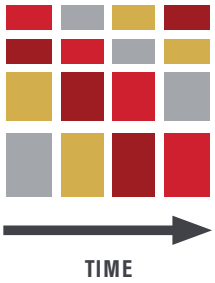
SEQUENTIAL / BLOCK

Training respective technical and non-technical components in a sequential linear fashion is a less the optimal approach for MMA. While focusing on specific training categories allows for the elevated development of that factor, MMA possesses too many individual factors to make this unilateral approach to development effective.



PARALLEL / CONCURRENT

Training multiple factors at the same time is a necessity in order to develop the wide range of technical and non-technical components needed for MMA. Training all components concurrently means coaches can target multiple training factors at the same time. However, the problem with this approach is that the time dedicated to each, or the stimulus provided, may be too small to make the impacts required.

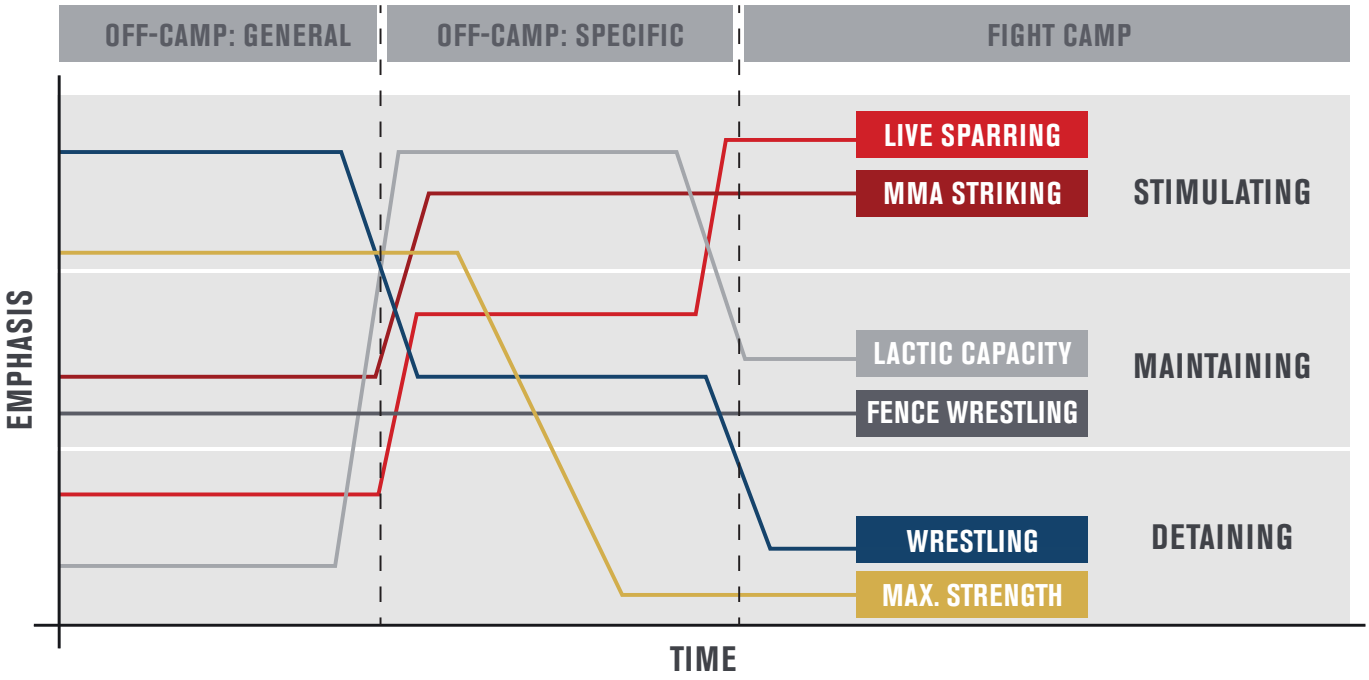


EMPHASIS

Like the parallel/concurrent approach, an emphasis-based approach allows for multiple training targets to be addressed at the same time. However, by changing the magnitude of 'emphasis' placed on the respective training components, it becomes possible to manage the development, the maintenance or the detraining of certain components in accordance with the training phases (i.e., off-camp general preparation, off-camp specific preparation, fight-camp).

FIGURE 17.3

EXAMPLE CHANGE IN CONCURRENT TRAINING EMPHASIS THROUGHOUT THE VARIOUS TRAINING PHASES



An emphasis approach to concurrent technical and non-technical training distribution allows the best components of other programming philosophies to be combined. It is possible to increase the "emphasis" on particular training factors (e.g., wrestling) to ensure that development occurs in this area. The emphasis approach also supports the training of multiple other factors (e.g., not just wrestling) concurrently. One downside of the parallel/concurrent approach is it is impossible to develop all training components optimally at the same time. However, by placing different emphasis on all training factors in the extent to which they are trained, and/or interfere with each other, a fighter's optimal development can be better managed. Within the emphasis approach, some factors are being developed, some are been maintained, and others are potentially detraining. The way in which this emphasis is distributed can then be aligned to the overarching objectives of each training phase (see Section 15), where coaches can distribute workloads to match the needs of each phase and are safe in the knowledge that all training factors are being targeted to some extent during a fight cycle (see Figure 17.3).


Southie



PART 1
SECTION 18

SECTION 18: SKILL ACQUISITION

By Dean Amasinger and Duncan French

As discussed in previous sections, MMA requires a diverse portfolio of technical and tactical skills in order to compete and be successful. The need for a well-rounded skill set with regards to the individual technical categories (e.g., striking, grappling, wrestling) have long been established. However, in the modern era of MMA, unique techniques to MMA such as fence wrestling and transitions between striking to wrestling have developed as technical categories in themselves. The high demand for technical proficiency means that efficiency in the learning process is critical in the development of world-class MMA athletes as the sport continues to evolve.

Historically, traditional martial arts training—and even boxing or wrestling—has been constructed of repetition-orientated practice (e.g., Kata in karate). Today, this can be described as "naïve" practice, as it lacks the planning and individualization that comes from a need's analysis directed method. The focused, organized and goal-orientated system of deliberate practice is a more efficient method of skill acquisition. The demand for technical proficiency across such a broad MMA skillset means that effective "transfer" to competition from the learning process (i.e., training transfer) is paramount for the development of world-class MMA athletes (Figure 18.1).

YOU CAN ONLY FIGHT THE WAY YOU PRACTICE!

– MIYAMOTO MUSASHI, THE BOOK OF FIVE RINGS

To make any learning process efficient and to maximize the likelihood of training transfer to competition, coaches should establish a focused, organized and goal-orientated skill acquisition system (i.e., skill-development process). Fundament components of such a system include i) well-defined goals and learning outcomes for each training session and training cycle, ii) high levels of focus and attention given to technical proficiency in specific techniques and motor tasks, iii) constructive and well-communicated feedback mechanisms that promote awareness of development needs and iv) the ability to develop a mental representation of expertise (i.e., technical imagery). Indeed, to develop expert performance of a skill during the skill-acquisition process, the mind must move through several cognitive states of comprehension. Each successive state corresponds to a more defined mental representation of the desired technical outcome, such that it can be used for goal setting, monitoring performance and modifying performance outcomes.

FIGURE 18.1
CONTEXTUAL INTERFERENCE USING DIFFERENT PRACTICE STRUCTURES TO PROMOTE MOTOR LEARNING AND TECHNICAL SKILL ACQUISITION

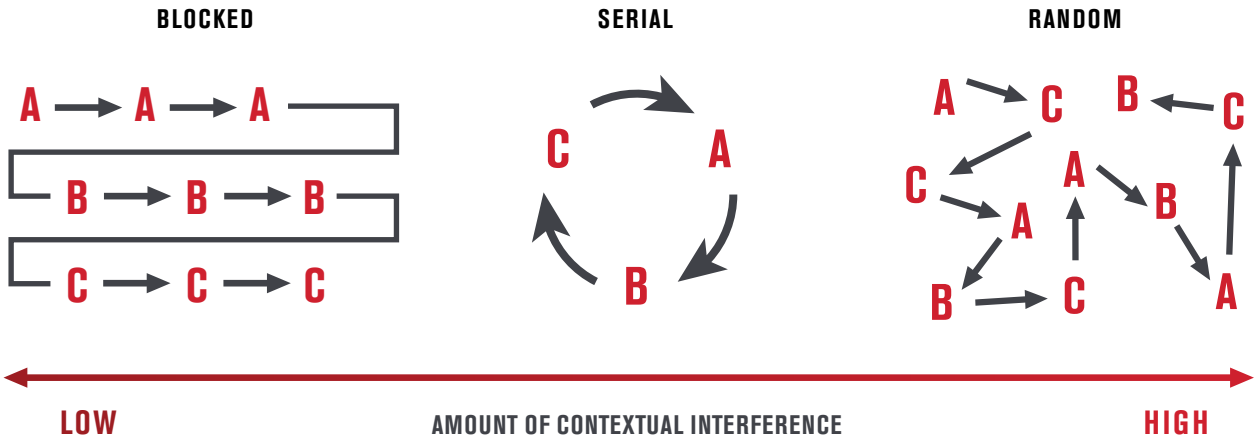
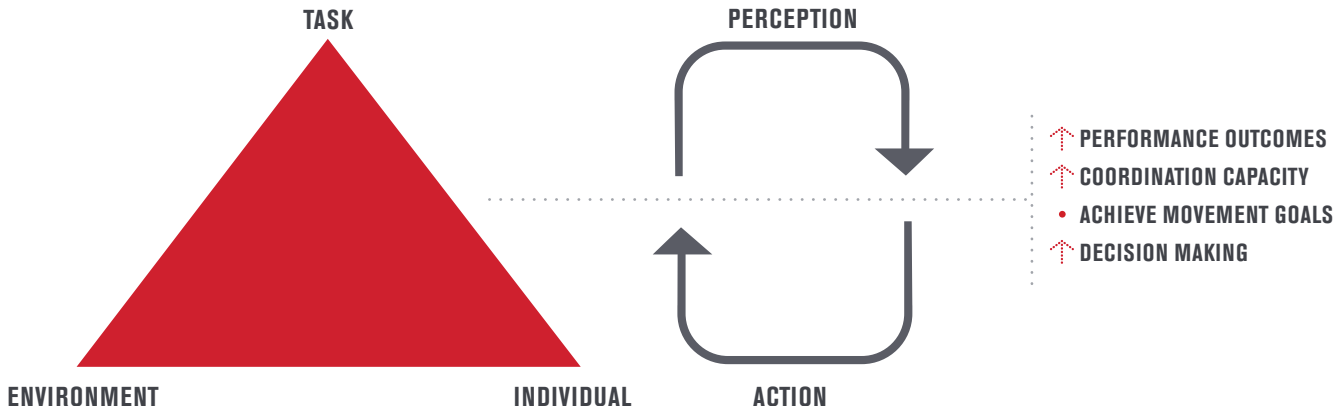


FIGURE 18.2
A CONSTRAINTS-LEAD APPROACH TO SKILL ACQUISITION
(TAKEN FROM NEWELL, 1986)



"SOME SAY, 'PRACTICE MAKES PERFECT', BUT WITH RESPECT TO THE WAY IN WHICH ATHLETES LEARN AND DEVELOP NEW SKILLS IT IS, 'IMPERFECT PRACTICE THAT MAKES PERFECT.'"

Transfer of skills from training to competition is the primary aim of technical training/drilling. All coaching styles and training modalities should be considered by their ability for transfer and to affect performance. Due to the paradox of never fully knowing if a training intervention is impactful on performance until after it has been completed, we recommend coaches design drills and training sessions with a comprehension of two fundamental skill acquisition considerations: i) adopting the principles of dynamic correspondence and ii) the use of constraints-led approaches to coaching.

Dynamic correspondence refers to specialized drills and exercises that have high transferability to sports performance, largely because of characteristics that define them (e.g., movement ranges and direction, muscular-force characteristic, regime of muscular work). In dynamic-correspondence theory, highly stable and reproducible positions within a skill (e.g., shoulder internal rotation when throwing a punch) are known as attractors. Meanwhile, changes in the environment (e.g., moving forward to throw attacking punches vs moving backward and throwing counterpunches) are known as fluctuators. By progressively adapting the training environment to impact the attractors of a skill (i.e., strategically manipulating fluctuators to make it progressively more difficult for an athlete to perform the skill), a higher and more stable transfer from training to competition can be achieved if managed appropriately according to an athlete's ability to meet the demands of a given task.

One way of managing the fluctuations in training is using a constraints-led approach to skill acquisition (i.e., putting and manipulating constraints on the fluctuations during skills training). This manipulation of the constraints under which technical drills or live work are performed ultimately influences the robustness of skill "attractors" in competition and the athlete's perception-action processing. This is due to the athlete having to "find" the skill under varying levels of complexity (i.e., less-than-perfect or changing circumstances, which is closer to competition environments). Within the constraints-led model of skill acquisition, there are three types of constraints that a coach can manipulate: i) the individual, ii) the environment and iii) the task (Figure 18.2). Individual constraints can include things such as athlete height and weight, his or her level of fatigue or motivation and his or her preferences (e.g., southpaw or orthodox, stylistic background; wrestler vs kick boxer). Environmental constraints are properties of the physical environment (e.g., 25-foot vs 30-foot Octagon, canvas vs rubber mats, temperature). And finally, task constraints relate to the parameters or the characteristics of a task being performed (e.g., shark tank drill in which fresh partners are introduced, takedown drills wearing bungee resistance bands, or grappling escape drills always starting from the bottom position or a less-than-advantageous position).

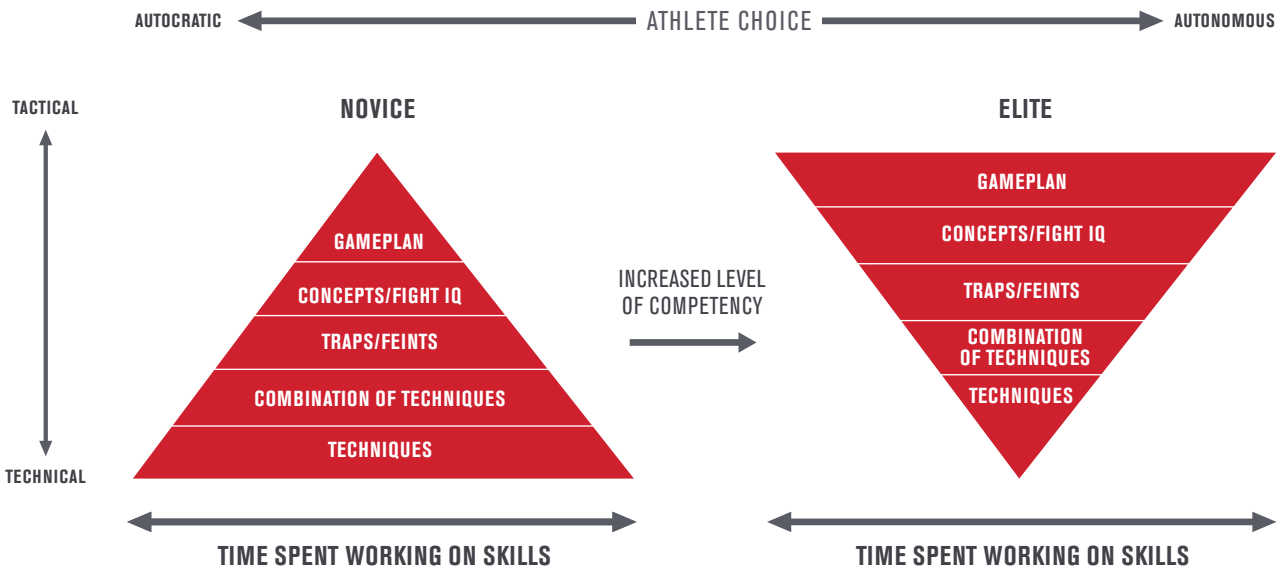


COACHES TALK

As a coach, you don't want to be a crutch for your athlete. You want to be a springboard. Involve the athlete in the training process. The more decision making the athlete does the better. Give the athlete the tools to improve and critically evaluate what works best for his or her body. The aim is to make the athlete an active participant in the learning process, rather than a passive recipient of information. A coach should facilitate athletes' journeys to understanding their bodies and finding the most efficient techniques/tactics to support their styles.

"YOU DON'T RISE TO YOUR COMPETITION. YOU FALL TO THE LEVEL OF YOUR TRAINING."

FIGURE 18.3
AUTOCRATIC-AUTONOMOUS SPECTRUM AND LONG-TERM SKILL DEVELOPMENT IN MMA



Beyond the coaching and skill-acquisition methods employed, considerations around the athlete-coach relationship and buy-in are important for the connection to skill acquisition and training transfer, both of which are related to attention. Attention to a skill is like water to a flower; the more that attention is given, the more a skill will flourish, grow and develop.

Focusing an athlete's attention can be improved by the way in which a coach communicates in terms of a multi-sensory approach and the types of cues used. Attention can be developed through the use of effective communication strategies, in which coaches can emphasize key learning factors by changing when and how they use different verbal and non-verbal cues. Depending on the level of the fighter (e.g., novice to elite), these cues can be delivered in an autocratic fashion, or training sessions can be set up such that athletes can develop new skillsets autonomously (Figure 18.3). By coaches varying the types of communication and cues used, it will help keep athletes attentive and engaged. It will also prevent over-cueing from the coach, which can be just as detrimental to athlete performance as not identifying development opportunities at all.

The constraints used by coaches in training should be periodized depending on the phase of fight preparation (e.g., off-camp, fight-camp) and also the athlete's technical level and training history. Figure 18.3 shows both the different technical-tactical emphasis, as well as the level of athlete autonomy (or choice) as an athlete develops from novice to elite performer. For example, as an athlete develops from novice to elite performer, they should have more and more autonomy over what they will do in training. When developing as a novice and even as a beginner, the foundations of technical skills require a greater allocation of training time.

SET THE 'INTENTION' TO FOCUS THE 'ATTENTION.'

Those foundations need to be trained extensively, so that more advanced aspects of the tactical considerations are within the technical capacity of the athlete (i.e., they have the technical tools to execute the tactical plans). As their level of competency increases, the allocation of training time can shift to more tactical and mental development. It is harder to make large technical improvements once an athlete has achieved a high level of technical proficiency. This level of technical or tactical emphasis and athlete autonomy can also be periodized in the short term (e.g., within a fight preparation; see Section 15).





PART 1
SECTION 19

SECTION 19: TRAINING-LOAD MANAGEMENT IN MMA

By Joseph Coyne, Felix Falkenberg and Dean Amasinger

Training-load (TL) monitoring is an extension of periodization theory and is an attempt to quantify two interrelated relationships: i) the training–performance relationship (e.g., how much training will result in a good or bad performance?) and ii) the training–injury/illness relationship (e.g., how much training will prevent or cause injury/illness?). Both of these relationships appear to be an inverted "U" shape. If an athlete completes too much or too little training, there is a higher likelihood of performing poorly, getting injured or falling ill. These relationships can also be moderated by a number of factors, including an athlete's age, his or her previous injury history or physical attributes (e.g., strength, endurance).

As it is impossible to accurately identify the effects of training without a precise quantification of TL, the measurement of TL becomes important. There are a number of measures that can be used in MMA to measure TL. These measures will typically assess either internal TL (i.e., the athlete's response to the training) or external TL (i.e., the mechanical work performed in training by the athlete). It is important to note that these measures can be both objective and subjective, as well as used for both short-term (e.g., "Do I need to adjust training today for the athlete?") or long-term (e.g., "How do I need to adjust training over the next week(s) for my athlete?") decision-making. It is common for TL measures to combined with markers of athlete readiness (e.g., heart rate variability, countermovement jump) to monitor athletes. Simple subjective measures seem to be more sensitive to TL than objective measures for monitoring athlete readiness and may be preferred for that reason, along with their ease and low cost of implementation. Informal measures of TL or athlete readiness can also be used by coaches and may include an athlete's body language, conversation or warm-up approach. A list of potential subjective and objective measures to monitor TL and athlete readiness for MMA are provided in Table 19.1.

In regard to measuring internal TL, one of the most widely recommended measures across all sports is sessional ratings of perceived exertion (sRPE) which will give a representation of the athlete's overall mental, biomechanical and physiological response

TABLE 19.1

EXAMPLES OF DIFFERENT INTERNAL AND EXTERNAL TRAINING LOAD AND ATHLETE READINESS MEASURES SUITABLE FOR MMA ATHLETES

		MEASURE TYPE	
		SUBJECTIVE	OBJECTIVE
DECISION TYPE	SHORT-TERM	Acute/Short Recovery and Stress Scale (Kellmann & Kolling, 2018) or other subjective wellness measures	Heart Rate Variability Direct Current Potential Countermovement Jump Analysis Blood or Salivary Markers (e.g. lactate, creatine kinase, testosterone: cortisol)
	LONG-TERM	Sessional Rating of Perceived Exertion (Foster, 1995)	Heart Rate Training Live: Drilling Ratio PlayerLoad™ per minute (accelerometery)

NOTE: A lot of the short-term decision-making measures may also be able to be used as long-term decision-making measures and vice versa. For example, HRV or countermovement jump long-term trend analysis may be used for long-term decisions.



to training. As such, it is the primary TL measure we recommend for MMA. To implement sRPE with athletes, there are a number of practical recommendations: i) using the validated CR-10 or CR-100 scales (see Table 19.2 for the validated CR-10 scale), ii) always have the athlete rate the session according to the verbal anchor first and then match it to the corresponding number and iii) always obtain the athlete's rating individually. We also recommend training athletes to improve their ability to rate sessions using the "blackness" test and educating them on how and when training will be adjusted based their response. For external TL, tri-axial accelerometry, and in particular PlayerLoadTM, is a validated measure for MMA. However, the cost of tri-axial accelerometers (e.g., catapult minimax units) may be prohibitive for many MMA programs, and there are also potential issues with wearing the units in training and sparring. An alternative external TL measure is the ratio of live work (e.g., sparring, live goes) to drilling (e.g., technique work). The live:drill ratio is an estimate of the intensity of the session. Generally sessions with a higher live:drill ratio will be more intense for athletes and vice versa. Furthermore, additional factors such as work-to-rest ratio numbers, "freshness" and relative ability of training partners and task constraints can all be used to manipulate training intensity, and therefore TL.

Once internal and external measures have been chosen, TL is then calculated as training impulse, which is the product of an intensity variable (e.g., sRPE) multiplied by a volume or duration variable (e.g., time in minutes). For example, if an athlete reported an sRPE of moderate (3 on CR-10 scale) and the training duration was 115 minutes, the training impulse would be 345 arbitrary units (3 x 115 = 345). From the training impulse, an athlete's overall training response is modelled as the difference between "fitness" (chronic TL) and "fatigue" (acute TL). There are two simple measures that can use training impulse data to assess the difference between "fitness" and "fatigue": i) training stress balance and ii) the acute-to-chronic-workload ratio (Hulin, Gabbett, and Blanch, 2014). Training stress balance (TSB) is the chronic TL minus the acute TL, and the acute-to-chronic-workload ratio (ACWR) is the acute TL divided by the chronic TL. Both these measures quantify change in TL, and although there are some statistical concerns with the ACWR, both can be applied as guides for coaches to understand an athlete's change in TL.

FIGURE 19.2
THE CATEGORY RATIO-10 SESSIONAL RATING OF PERCEIVED EXERTION SCALE

0	NOTHING AT ALL
.5	EXTREMELY WEAK (JUST NOTICEABLE)
1	VERY WEAK
2	WEAK (LIGHT)
3	MODERATE
4	SOMEWHAT STRONG
5	STRONG (HEAVY)
6	
7	VERY STRONG
8	
9	
10	EXTREMELY STRONG (MAXIMAL)
*	ABSOLUTE MAX (HIGHEST POSSIBLE)

TABLE 19.3

ATHLETE INTERNAL TRAINING LOAD (± STANDARD DEVIATION) THROUGHOUT OFF-CAMP AND FIGHT-CAMP, DIVIDED INTO TECHNICAL TRAINING (TT) AND NON-TECHNICAL TRAINING (NTT)

This table also shows ratio of technical to non-technical training (TT:NTT)

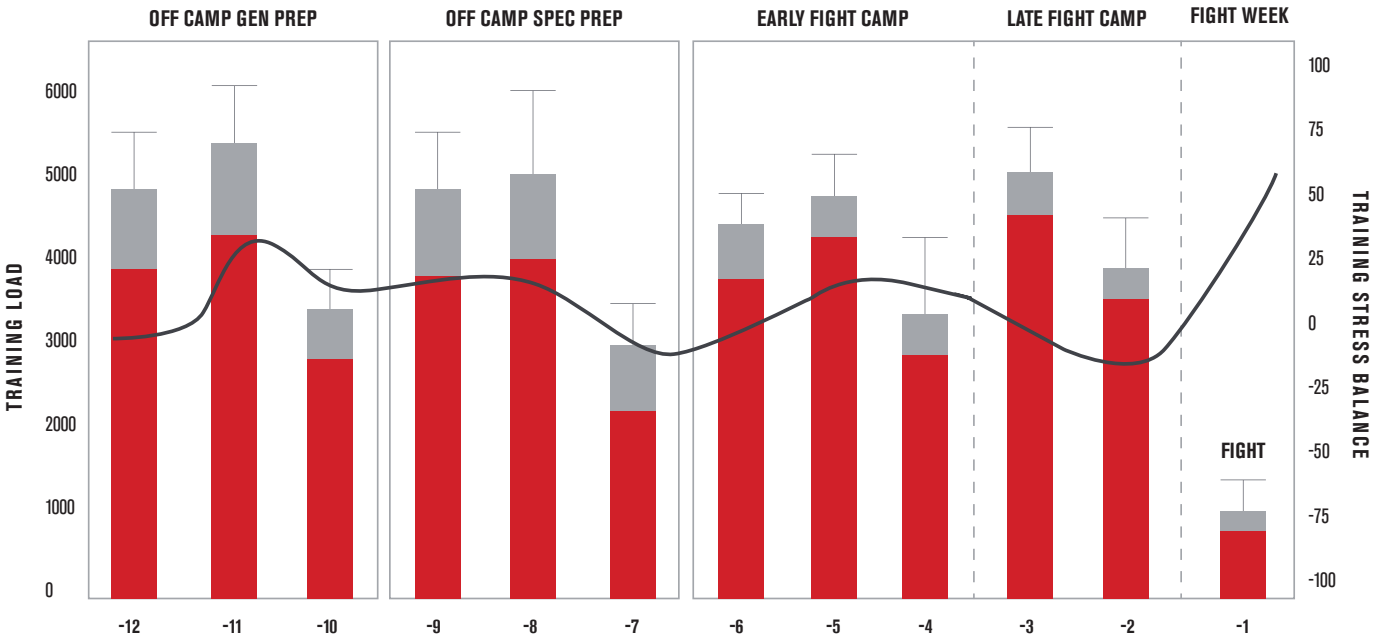
OFF-CAMP						
	GENERAL PREPARATION			SPECIFIC PREPARATION		
	-12	-11	-10	-9	-8	-7
TT	3936 ± 570	4334 ± 820	2769 ± 506	3837 ± 713	4059 ± 863	2519 ± 364
NTT	954 ± 238	1101 ± 158	536 ± 106	924 ± 247	1074 ± 209	508 ± 117
TOTAL	4889 ± 801	5436 ± 961	3306 ± 592	4761 ± 901	5133 ± 971	3027 ± 474
TT: NTT	82% : 18%	79% : 21%	80% : 20%	80% : 20%	77% : 23%	79% : 21%
FIGHT CAMP						
	EARLY			LATE		
	-6	-5	-4	-3	-2	-1
TT	3957 ± 549	4254 ± 494	3050 ± 503	4634 ± 651	3608 ± 514	874 ± 166
NTT	469 ± 151	474 ± 158	291 ± 67	429 ± 95	366 ± 139	177 ± 52
TOTAL	4425 ± 671	4725 ± 588	3342 ± 560	5063 ± 722	3973 ± 616	1051 ± 200
TT: NTT	92% : 8%	94% : 6%	94% : 6%	95% : 5%	94% : 6%	90% : 10%

To calculate TSB or the ACWR, we recommend that the acute and chronic TL periods are similar to the micro and mesocycle lengths of the athlete's MMA program (see Section 15). For instance, if the MMA training program works in three-week blocks (e.g., with a deload week every third week), the acute and chronic TL periods would be seven and 21 days respectively. The acute and chronic TL values are then the smoothed average of TL over the acute and chronic periods (e.g., in this instance, the last seven (acute) and 21 (chronic) days TL). Because of the short-term training nature of MMA in which fights are generally booked fewer than 16 weeks prior, we also recommend using exponentially weighted moving averages (EWMA) to smooth the acute and chronic TL periods. Besides enabling more efficient calculation of TL, EWMA may also better represent physiological responses to training, as well as being more sensitive to performance and injury risk than rolling or simple moving averages. As an example, the weekly levels of TL for athletes in the UFC Academy over off-camp and fight-camp for technical and non-technical training as well as their overall TSB are presented in Table 19.3 and Figure 19.1.

It should be mentioned that internal TL (despite being somewhat dependent on external TL) ultimately determines the training outcome for athletes. There is also the consideration that there maybe is a high isometric component in some MMA training (e.g., grappling situations where one opponent is pinning the other to the fence or floor) in which there is no work being completed (in a physics sense), but the athlete is still having to use energy and effort to maintain or fight that position. As external TL measures primarily quantify mechanical work, it may not be possible to accurately quantify this isometric component of MMA. This makes accurately recording and monitoring internal TL measures even more important for MMA. Regardless, it is recommended that both

FIGURE 19.1

THE INTERNAL TRAINING LOAD AND TRAINING STRESS BALANCE IN OFF-CAMP AND FIGHT-CAMP FOR MMA ATHLETES IN THE UFC ACADEMY



internal and external TL are applied (if possible) and their relationship monitored to optimize the training of MMA athletes. Figure 19.2 depicts possible scenarios in the internal and external TL relationship for an MMA athlete that may help coaches decide on any training changes (if needed). For instance, a consistent trend of greater external TL with consistent internal TL responses over time may represent a positive adaptation to training and TL can be increased (Figure 19.2A). On the other hand, a consistent trend of greater internal TL responses with a consistent external TL may indicate a negative adaptation to training, and TL may need to be reduced (Figure 19.2B). For coaches wishing to quantify this relationship, we recommend using the training efficiency index (TEI), which is an exponential ratio of external to log-transformed internal TL.

FIGURE 19.2

POSSIBLE CONCEPTUAL INTERACTIONS BETWEEN INTERNAL AND EXTERNAL TRAINING LOAD AND ATHLETE ADAPTATIONS

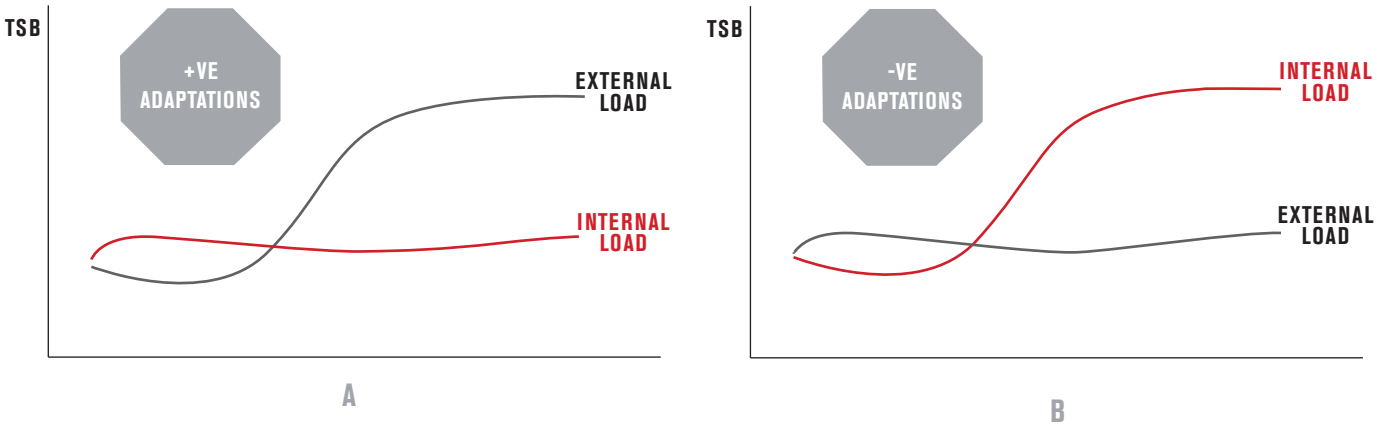


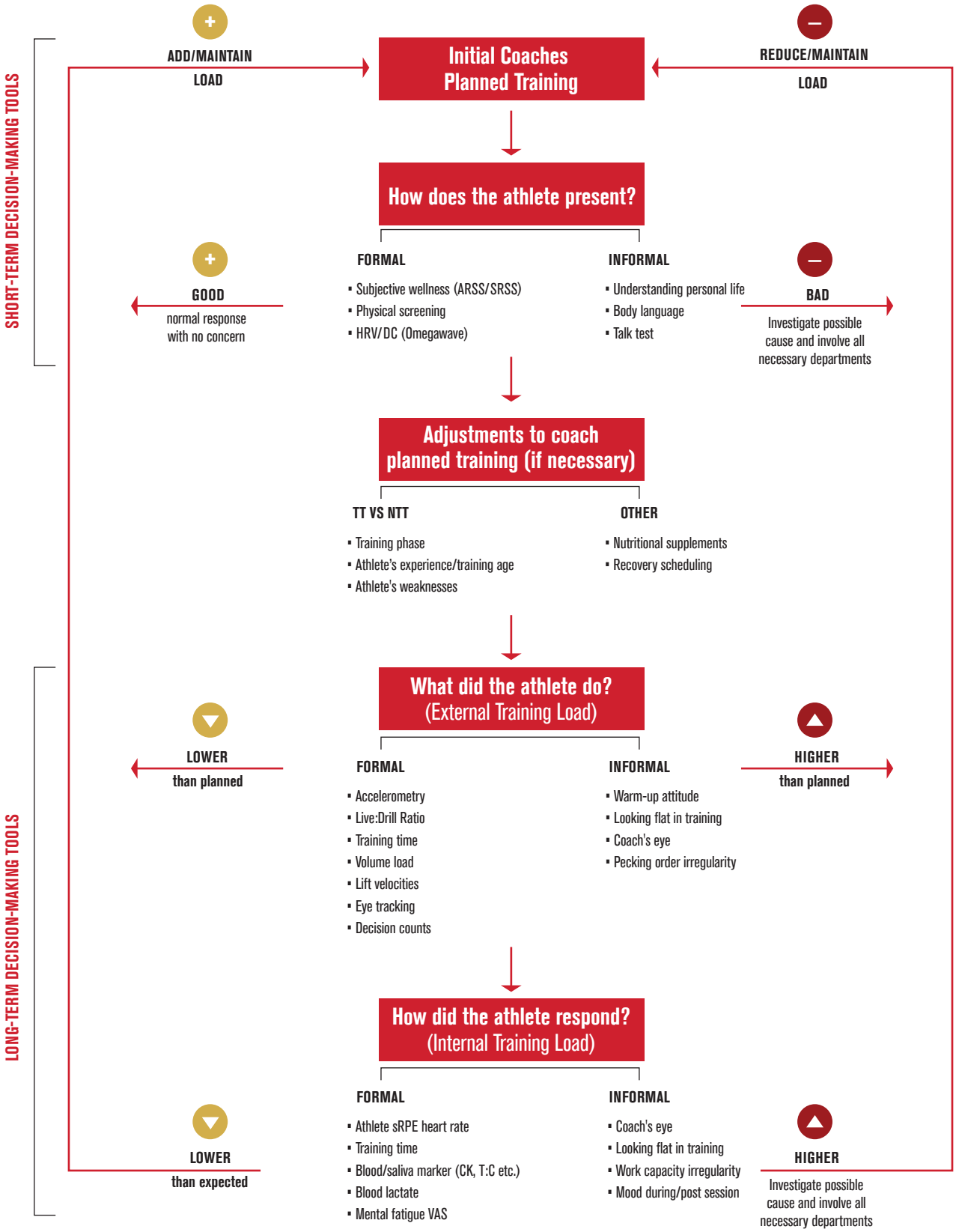

Figure 5.12
VO2MAX. (ml O2/KG/MIN) BE
WOMEN'S STRAWWEIGHT (115lb)
WORLD-LEADING ≤ 59.7
EXCELLENT 57.3 - 59.7
VERY GOOD 54.8 - 57.3
GOOD 52.4 - 54.8
FAIR 47.5 - 52.4
POOR 45.0 - 47.4
VERY POOR 42.6 - 45.0
BAD ≤ 42.5
WOMEN'S FLYWEIGHT (125lb)
WORLD-LEADING ≤ 52.5
EXCELLENT 51.5 - 52.5
VERY GOOD 50.4 - 51.5
GOOD 49.4 - 50.4
FAIR 47.3 - 49.4
POOR 46.2 - 47.2
VERY POOR 45.2 - 46.2
BAD ≤ 45.1
LIGHTWEIGHT (155lb)
≤ 70.11
67.21 - 70.10
64.31 - 67.20
61.41 - 64.30
55.60 - 61.40
52.70 - 55.59
49.80 - 52.69
≤ 49.79



PART 1
SECTION 20

ATHLETE MONITORING AND DECISION MAKING

By Felix Falkenberg, Joseph Coyne and Dean Amasinger



Adapted from Gabbett et al, 2017

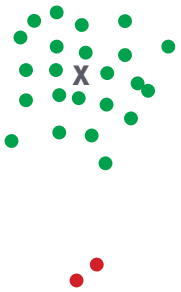
TRAINING LOAD



EXAMPLE SESSION 1

Outcome: Individual athlete response is higher than coach's plan

Next Steps: Investigate reasons for these individuals' high response, and if needed, involve necessary department.

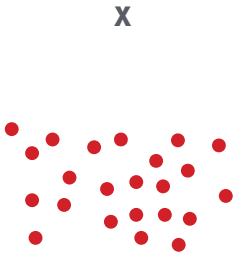


EXAMPLE SESSION 2

Outcome: Individual athlete response is lower than coach's plan

Next Steps: Investigate reasons for these individuals' low response, and if needed, consider manipulating training session design for those individuals to increase training load.

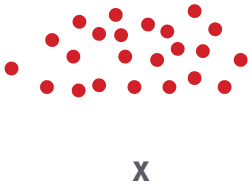
TRAINING LOAD



EXAMPLE SESSION 3

Outcome: Team response is unified but lower than coach's plan

Next Steps: Consider manipulating training session design to increase training load for the complete squad.



EXAMPLE SESSION 4

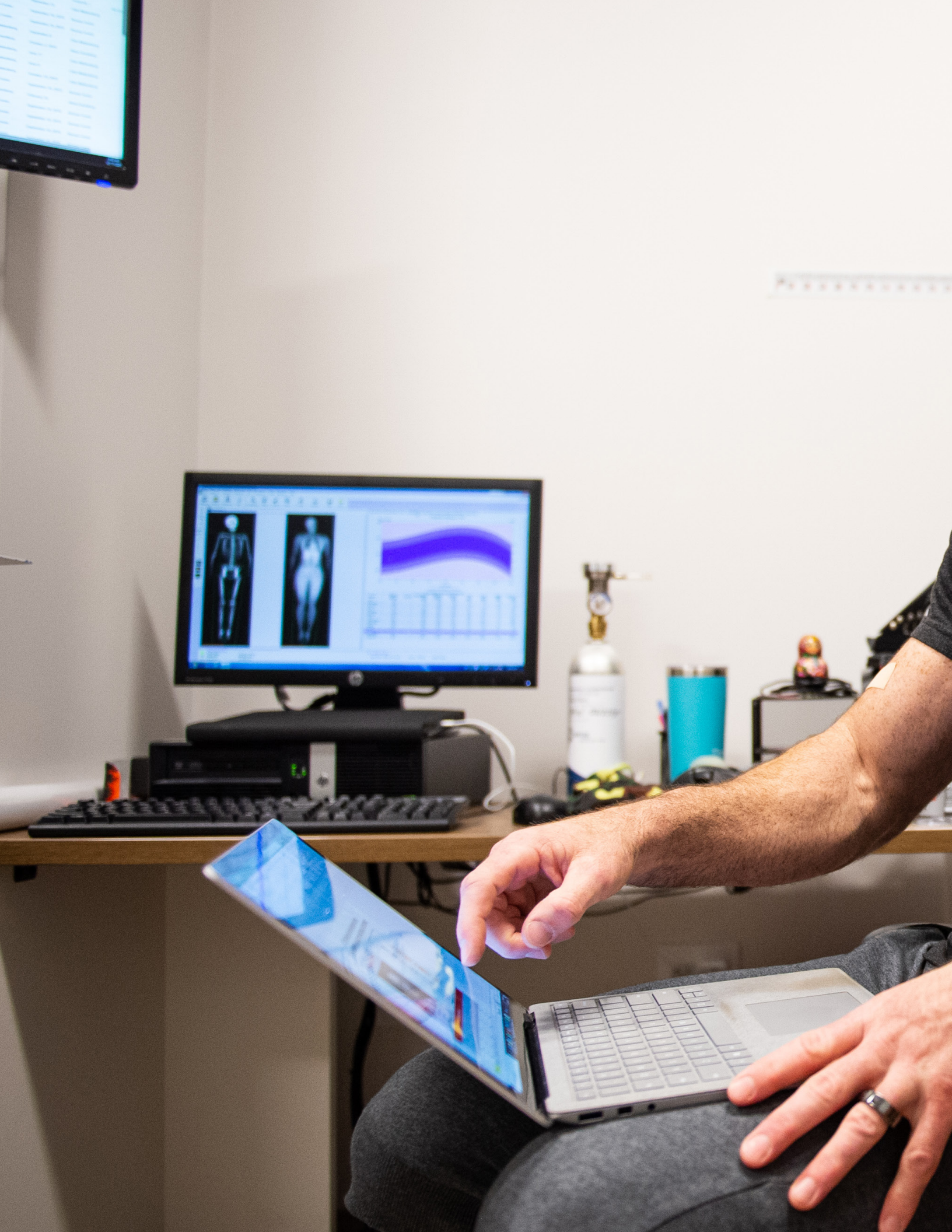
Outcome: Team response is unified but higher than coach's plan

Next Steps: Consider manipulating training session design to decrease training load for the complete squad.

x Coach's planned training load

● Individual fighters whose response is consistent with planned training load

● Individual fighters whose response is inconsistent with planned training load





PART 1

SECTION 21

SECTION 21: INDIVIDUALIZING ATHLETE MONITORING

By Felix Falkenberg

UFC athletes train all over the world in different environments and with access to a variety of resources. While the UFC PI is equipped with the latest sports medicine, strength and conditioning, sport science and performance nutrition technology, this is not the norm for the majority of MMA gyms around the globe. Therefore, investigating every athlete's individual situation and training approach is essential when creating durable and effective monitoring strategies.



Athlete monitoring normally covers objective and subjective measures of either athlete readiness (e.g., "How does the fighter feel today?") or training load (e.g., "What did the athlete do in their training today?"). Other areas of monitoring can include orthopaedic assessments, such as shoulder range of motion or performance-related metrics, like the countermovement jump—which in some instances can be used as a proxy of neuromuscular function. As mentioned previously, it is not possible to identify the effects of training without precise quantification of training load, so athlete monitoring can play a very important part in manipulating training programs and the success of an athlete in MMA.

An individualized monitoring strategy starts with an intake assessment where athletes are interviewed in order to compile a picture of the athlete's current training and lifestyle characteristics. A sample intake assessment is provided in Figure 21.1, and this assessment can be adjusted for differences in language, time zones and cultural approaches.

Intake Assessment

UFC PERFORMANCE INSTITUTE SHANGHAI 精英训练中心上海

NAME:

WC/CURRENT WEIGHT/BODY FAT %:

ARRIVAL DATE: __/__/____

INTRODUCTION & GENERAL INFORMATION

- Operations hours, Food service, Appointment booking system, Academy schedule
- Intended duration of stay at UFC PI:
- Significant recent injuries or concerns:

CURRENT CAMP STATUS

- Off-Camp (General preparation or Specific preparation)
- Fight-Camp (Early or Late Camp)
- Strategy Phase
- Previous Fight Date (___/___/_____) – Next Fight Date (___/___/_____) confirmed or planned

UFC PI SHANGHAI SERVICES

- Sports Medicine – Orthopaedic Screen, Physiotherapy, Rehabilitation, Treatment, Concussion Screening
- Sport Science – Physiological monitoring (Omegawave/Oura), Physical Performance Testing
- Strength & Conditioning – Physical Performance Programming (local & remote)
- Performance Nutrition – Education, Weight-cut assistance, Meal preparation, Supplement provision

ACCOMPANYING PARTY

- Coaches:
- Training Partners:

GOALS FOR STAY AT UFC PI SHANGHAI

1.
2.
3.

POSSIBLE SCHEDULE

MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY

FIGURE 21.1

ATHLETE MONITORING TOOLS AND MEASURES

ATHLETE READINESS MEASURES	
OMEGAWAVE (HEART RATE VARIABILITY AND DIRECT CURRENT POTENTIAL)	Objective measure of overall, cardiac and central nervous systems readiness, Windows of Trainability
SHORT STRESS AND RECOVERY SCALE	Subjective measure of athlete wellness
SLEEP TRACKERS	Questionnaires on sleep quality/quantity, wearables
JUMP MEASURES	Neuromusccular function (eg, reactive strenth index-modified (RSI-mod)
GRIP MEASURES	Neuromusccular function (eg, maximal grip force)

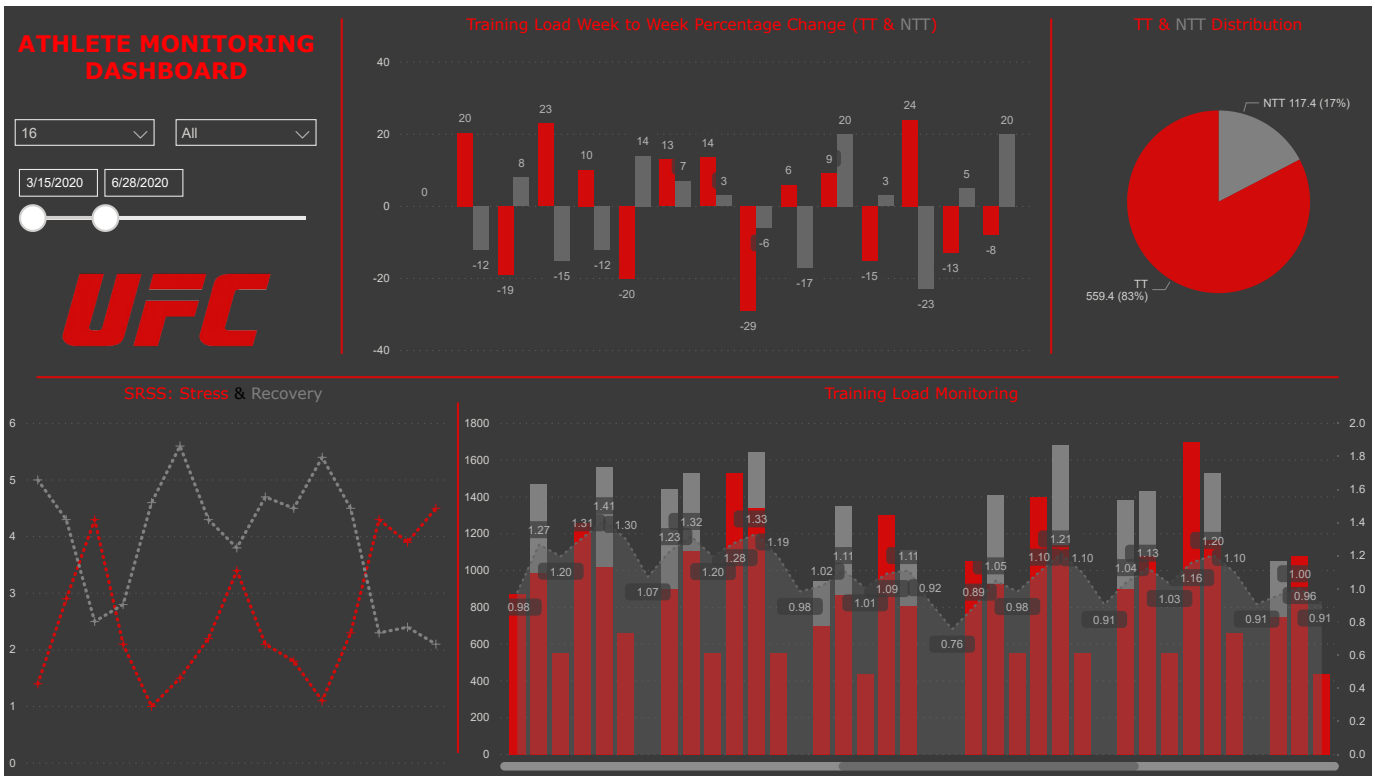
TRAINING LOAD MEASURES	
sRPE	Subjective internal response to training
HEART RATE	Objective internal response to training (eg, Polar)
VOLUME LOAD/INDEX	Objective external quantification of athlete work in strength & power training (eg, sets, repetitions, weight lifted analysis)
GLOBAL POSITIONING SYSTEM (GPS) AND ACCELEROMETRY	Objective external quantification of athlete work in conditioning (eg, Garmin, Strava, Zwift, Apple Watch)

There are many other factors that may impact the type of monitoring strategy that is best for an athlete. These include if the athlete has an existing monitoring system or has used one in the past, compared to an athlete with no previous experience with any type of athlete monitoring. Athlete buy-in, compliance, and frequency of communication (e.g., daily, bi-weekly, weekly) should also be considered, especially if the athlete is being monitored remotely. Further, results from physical performance, orthopaedic and nutrition assessments may also impact the monitoring strategy adopted for an athlete (e.g., if an athlete has been suffering from a neck injury, there may be value in monitoring sleep quality). These issues are considered, and using the intake assessment as an education session can help increase athlete buy-in and subsequently lead to consistent and regular data collection.

FIGURE 21.2

EXAMPLE DATA VISUALIZATION DASHBOARD FOR USE IN MONITORING ATHLETE TRAINING-LOAD DISTRIBUTION

(SOFTWARE: POWERBI)

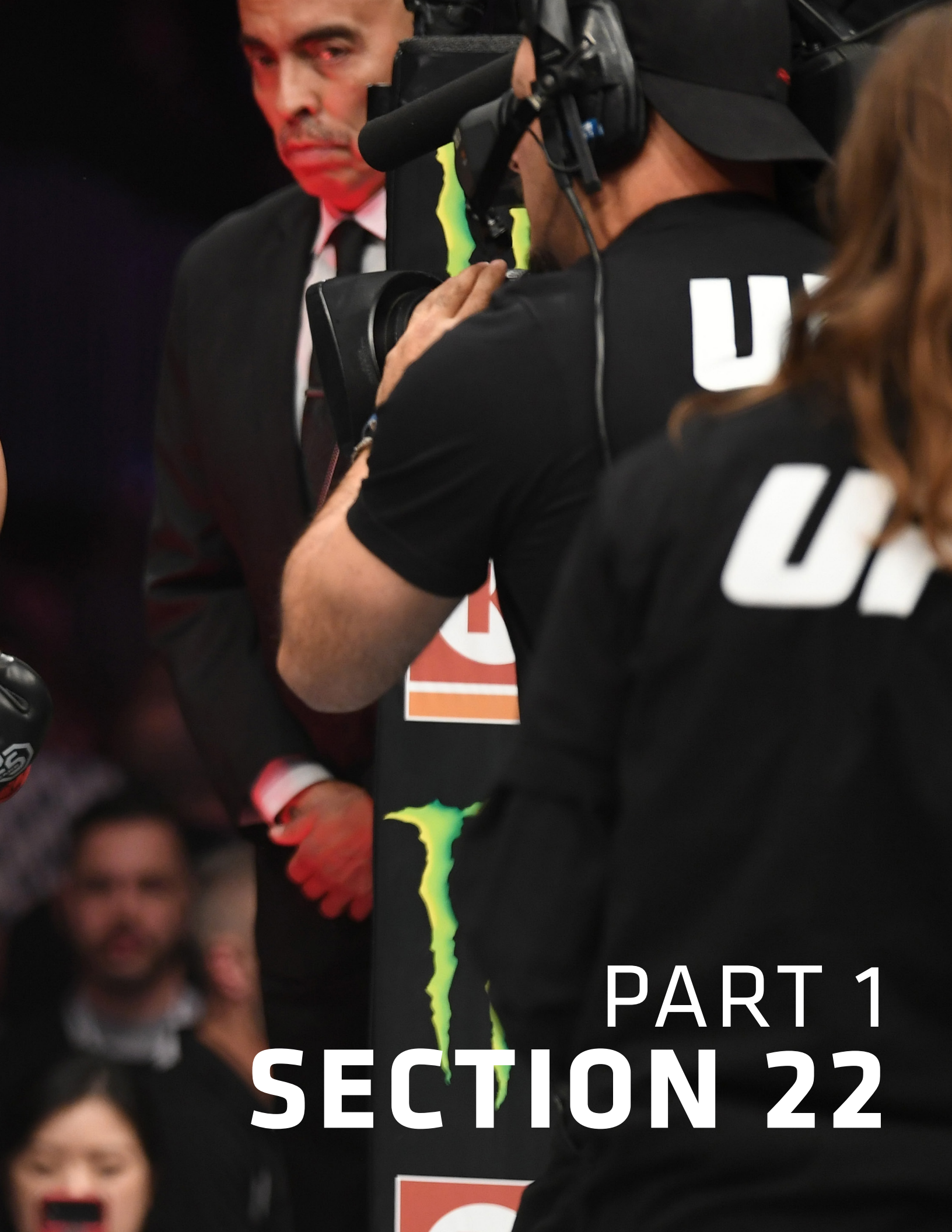


Once the intake assessment has been completed, the athlete will be introduced to the best available monitoring tools for their situation. These tools should be deployed on an a la carte basis, and not as a "one-size-fits-all" approach. Current athlete monitoring tools the UFC PI use are shown in Figure 21.1.

Once the athlete monitoring strategy and tools have been established, the establishment of a consistent monitoring routine is essential. Efficient data collection, analysis and communication (e.g., reports and visualizations) back to the athlete and coaches is crucial. The collection, analysis and reporting of data can be created with an athlete management software (e.g., Smartabase), other business intelligence or data visualization software (e.g., Excel, PowerBI, Tableau) or custom-made spreadsheets—depending on the individual athlete. An example of an interactive and daily updating dashboard that analyses are subjective athlete readiness (SRSS) and training load (sRPE) is shown in Figure 21.2. This will maximize the significance and effectiveness of athlete monitoring and help engage and create buy-in for athletes and coaches. Once baselines for various metrics can be computed and trends start to appear, continuing education on how to manipulate training based on the results of the monitoring tools is another very important step for any athlete monitoring strategy to be successful.

FURTHER, RESULTS FROM PHYSICAL PERFORMANCE, ORTHOPAEDIC AND NUTRITION ASSESSMENTS MAY ALSO IMPACT THE MONITORING STRATEGY ADOPTED FOR AN ATHLETE.


UFC



PART 1
SECTION 22

SECTION 22: READINESS AND TRAINABILITY

By Roman Fomin and Matthew Crawley

Physical training (both technical and non-technical) leads to structural and functional adaptations in cells, tissues and organs. When managed correctly, these adaptations lead to beneficial training effects, such as enhanced working capacity, the development of fundamental physical qualities (e.g., strength, speed, power, endurance, coordination) and improvement in both general and sport-specific physical preparedness. To induce beneficial adaptations, coaches and support personnel must apply an appropriate stimulus to the body by manipulating acute training variables such as exercise modality, frequency of training, volume and intensity. Variation in these training variables (i.e., overload and recovery) causes specific physiological shifts that lead to fluctuations in the normal functional state of the body and cause it to change and adapt.

Continuous monitoring of an athlete's functional state and his or her primary physiological systems (e.g., cardiovascular system, nervous system) is necessary in order to effectively manage the training process. Monitoring trends and patterns in an athlete's functional state over time will allow coaches to better understand the state of "readiness" or "non-readiness" of the athlete. Indeed, by understanding how an athlete responds to a particular training session or workout, it is possible to identify if the athlete has fully or partially recovered from the previous training. Insights from the data collected will then allow a coach to individualize and optimize the "dosage" of future training loads and apply the appropriate stimulus to achieve optimal training effects under the given conditions. In return, this will reduce the biological "cost of adaptation" and achieve training objectives without negative consequences and harmful effects to the athlete's health (i.e., the cost of adaptation increases if an athlete's functional state is suppressed yet he or she continues to be subjected to very demanding training loads). Monitoring and assessment of the current functional state of an athlete is the basis for individual planning and optimal management of training load in various training cycles. In general preparation phases, a suppressed functional state may be the stimulus for adaptation, whereas in fight-camp, the need to manage the magnitude of residual fatigue is imperative for the delivery of a fighter to compete in his or her optimal state.

READINESS FOR TRAINING

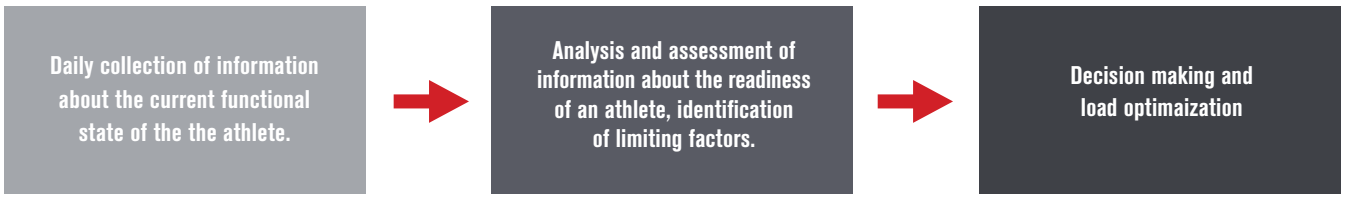
Implementing a readiness and recovery monitoring program is critical for helping athletes optimize readiness, improve physical preparedness and ultimately reduce injury risk and overtraining. Management and optimization of the training process should consider the following process:

1. Daily Collection of Information About Current Functional State Using Appropriate Methods and/or Technologies

The daily collection of information about the status of critical physiological systems within the athlete's body (e.g., central nervous system, autonomic nervous system, cardiac system and energy metabolism) and their acute and chronic responses to training loads are of great importance. This information reflects the current readiness of the athlete for the upcoming training load. There are many technologies in the marketplace that can support data capture, which include smart watches, wearables, app-based platforms and other collection modalities. However, at the most basic level, the measurement of resting heart rate upon waking can be used as a crude monitoring approach to gain valuable insights.

2. Analysis and Assessment of Information About the Current Functional State of the Athlete

At the second stage, a comprehensive analysis of the functional state should determine an athlete's physiological readiness for an upcoming training session. Overall readiness is assessed to un-





derstand the "dose" of the training load that should be applied in order to obtain the maximum training effect without negative consequences for the athlete. If an athlete's readiness is high, training load and demands can be increased. However if readiness is low, there may be a need to decrease the training stimulus to avoid overly suppressing the athlete's physiological systems.

The awareness of possible limiting factors in individual physiological systems are identified as lower levels of overall readiness. For example, if an athlete's central nervous system (CNS) has fully recovered from yesterday's training load, he or she may be considered "ready" for a new training session. If the cardiac system has not fully recovered and is in the state of fatigue (i.e., "non-readiness"), this will present a primary limiting factor by restricting the manifestation of maximum performance (e.g., endurance development). In this case, during any planned endurance training, if the athlete were to apply maximal load on their cardiac system (ignoring all negative feedback signals from the heart), it will significantly increase the "cost of adaptation" beyond its critical values with the potential of overtraining or possible risk of injury.

The next phase of the analysis is identifying the "windows of trainability" (i.e., their openness or closedness) for individual physical qualities. For example, if the CNS is completely ready for a training load and the cardiac system is not, then the window of trainability for the formation of useful adaptations in the CNS is open but closed for the cardiac system. In such a circumstance, this information suggests that this would be a favorable time for the development of strength, speed or power by stressing the neuromuscular system, but would be an unfavorable time for the development of endurance characteristics, which largely stress the cardiac system.

3. Decision Making, Adjustments and Training-Load Optimization

In the final stage, the purpose of daily monitoring is to influence decision making in accordance with the athlete's current functional state and apply adjustments or maintenance for upcoming training loads. If an athlete's data indicates he or she is ready, then the planned "dose" of the load remains the same. If the athlete is not ready, or showing signs of physiological suppression, then adjusting the type of load, reducing the volume and/or intensity of the load may be beneficial to the athlete at that time.


UFC
UFC



PART 1

SECTION 23

SECTION 23: FATIGUE & RECOVERY

By Felix Falkenberg and Tera Giroux

FIGURE 23.1
THE EIGHT-FACTOR MODEL OF RECOVERY AND FATIGUE



8. PREPARATION & PROFESSIONALISM
- Warm-up integration
- Specialized cool downs
- Routine implementation
- On-time arrival and punctuality
- Attitude and coachability

1. MANAGING TRAINING LOAD
- Training load trend analysis
- Planned training load vs. actual training load
- Live work to drilling ratios
- Internal vs. external training load

2. OBJECTIVE ATHLETE READINESS MONITORING (E.G., OMEGAWAVE)
- Direct current potential (central nervous system) and HRV (autonomic nervous system: sympathetic vs parasympathetic activation)
- Daily response and long-term trend analysis

7. COMMUNICATION
- Between interdisciplinary team (e.g., head coach, medical staff)
- Between training partners (e.g., training partners, sparring intensity levels)
- Injuries, limitations, training modifications
- Training-load management

3. SUBJECTIVE ATHLETE READINESS MONITORING (E.G., SRSS)
- Stress & recovery monitoring
- Questionnaire implementation
- Daily response and long-term trend analysis

6. PERIODIZATION
- Planned outcome of sessions
- Training load
- Intensity & volume changes
- Training distribution
- Deload phases

4. EFFECTIVE PLANNING
- Time away from or outside of technical or non-technical training
- Engage with medical staff
- Advanced treatment scheduling
- Before and after training routines

5. RECOVERY MODALITIES
- Availability of recovery tools
- Frequency and routine use
- Be aware of interference effects
- Individual preferences
- Hypertrophy mitigation

Fatigue can be defined in a variety of ways, from an acute decrease in muscle force production to the chronic or prolonged reductions in the capacity to exert maximal output. Prolonged fatigue may be evident in a number of ways, including a decreased ability to recover between training sessions and can lead to various negative outcomes such as injuries and poor performance. Fatigue can manifest in many different ways, including mental vs physical fatigue, and should be differentiated between the fatigue associated with planned overreaching during training and the detrimental chronic fatigue factors associated with overtraining syndrome.

Fatigue is an essential part of the training process. In order for a fighter to gain positive adaptations from training, a coach needs to load an athlete to generate some fatigue, such that a stimulus promotes change in biological systems. Therefore, fatigue should not be avoided entirely but instead appropriately managed and monitored to provide each individual with an appropriate "dose" of fatigue for optimal performance adaptations (see Figure 23.1).

To help athletes handle greater levels of training load, a periodized recovery strategy should be put in place. Table 23.1 outlines the recovery modalities used by the UFC PI so an athlete can handle higher training intensities and volumes without excessive fatigue, injuries or illness.

TABLE 23.1

EXAMPLE RECOVERY MODALITIES UTILIZED BY THE UFC PERFORMANCE INSTITUTE

		DETAILS	PROTOCOLS	TIMING
HYDROTHERAPY	COLD HOT CONTRAST	▪ Reduce muscle damage, minimize discomfort, the delay onset of muscle soreness, reduce perception of fatigue. ▪ Increase feeling of relaxation, parasympathetic rebound from cold, improve blood flow. ▪ Blood circulation: Vasodilation & vasoconstriction, positive effect on inflammation.	▪ Accumulate 8 minutes in the cold. ▪ Highest perceived results achieved by continued immersion. ▪ Total duration spend in the water depends on preference: ~20 minutes Hot : Cold Ratio 1:1 (x8) : 1:2 (x5); 2:2 (x4)	▪ After high biomechanical load sessions, especially effective after a heavy contact session (i.e. sparring). ▪ Hot water may be used for heat acclimation or improved mobility before and after sessions. ▪ Cold can be used for hypertrophy mitigation. Immediately after training session with no restriction on type of training or time of day.
	CRYOTHERAPY	Different types: Local cold therapy, 90% full- body immersion & cryotherapy chamber. Relieve muscle pain and muscle soreness. Also helps with swelling after soft- tissue damage.	Local cold therapy: 115 minutes 90% immersion: up to 3 minutes Chamber: 20 sec @-60 & 3 min @-110	Recommended after high- intensity and high-level-of- contact sessions. Can be used for hypertrophy mitigation.
	SAUNA	General health benefits:, Reduce markers of inflammation, increases blood flow, decreases rating of muscle soreness in athletes, increased heat shock proteins.	20-40 minutes total sauna per day OR 10 minutes sauna followed by 2 minutes normal temperature repeated 2-3 times (x2-4 per week)	Can be implemented at any time after training. Exact duration and sauna exposure depends on various factors (e.g., weight cutting.). Can be used for heat acclimation.
	NORMATEC	Dynamic compressions enhance the movement of fluid and metabolites out of the limbs. Lowers pain and soreness rating, decrease muscle fatigue.	The units allow for individual duration and intensity adjustment. The protocols vary depending on athlete circumstance.	Most effectively used directly after exercise when the body and muscles are fatigued. Also effective when used in relaxed state (e.g., rest day).
	GAMEREADY	Recovery & rehabilitation device combining compression and cooling to different limbs. Improved pain relief, reduced stiffness and pain intensity.	The system allows the athlete and trainer to adjust the duration and intensity. The most common duration is between 15-30 minutes.	Can be implemented any time when the athlete feels uncomfortable in injured area. Right after immediately following workouts or in rehabilitation.
	BREATHWORK	Induces a calming effect on the body through autonomic nervous system. Will decrease physiological and mental markers of stress (e..g., blood pressure.).	Box breathing; 4 secs inhale, 4 secs hold, 4 secs exhale, 4 secs hold (x5 minutes); prolonged breath holds (30+ secondssec) mixed with a series of deep and controlled breaths.	Breathwork can be undertaken at any time. Right after waking up, before exercise, after exercise, in the evening. Depends on athlete's preference and aims of intervention.



From the recovery modalities available, an individualized recovery schedule can be created for an athlete. Considerations on how to create a recovery schedule (Figure 23.2A) and an example schedule (Figure 23.2B) are detailed on the opposite page. By combining the recovery strategies with training load and athlete readiness monitoring, as well as utilizing effective periodization of training, the risks of fatigue-related injury or poor performance can be significantly reduced.

FIGURE 23.2

DEVELOPING AN INDIVIDUAL APPROACH TO RECOVERY THROUGH A RECOVERY SCHEDULE

EXAMPLE MMA TRAINING SCHEDULE

Training intensity, volume and session breakdown provides guidelines for recovery scheduling.
Differences between off-camp and fight-camp due to training intensity and other interventions (e.g., weight cut).
Rest periods, as well as self-directed recovery selection, to maximize autonomy, effectiveness and perceived benefits .

		TRAINING SCHEDULE		RECOVERY SCHEDULE	
		TT	NTT	OFF-CAMP	FIGHT-CAMP
MON	AM	MMA		BREATH WORK (OPTION GROUP 1 - LAND | GROUP 2 - WATER)	
	PM	MMA	S&C	CONTRAST BATH	CONTRAST BATH
TUES	AM	SPARRING		ICE BATH	CYRO
	PM	MMA	S&C	SAUNA	CONTRAST BATH
WED	AM	MMA		SELF DIRECTED (SAUNA FOR HEAT ACCLIMATION)	
	PM	OFF			
THUR	AM	MMA		BREATH WORK (OPTION GROUP 1 - LAND | GROUP 2 - WATER)	
	PM	MMA		NORMATEC / GAME READY / SOFT	CONTRAST BATH
FRI	AM	SPARRING		CYRO	ICE BATH
	PM	MMA	S&C	SAUNA	STEAM ROOM
SAT	AM	MMA		SAUNA	STEAM ROOM
	PM	OFF		SELF DIRECTED (SAUNA FOR HEAT ACCLIMATION)	
SUN	AM	OFF			
	PM	OFF			

TECHNICAL TTRAINING (TT)

Intensity and duration of session
Type of session (e.g., sparring)
Subsequent training

NON-TECHNICAL TRAINING (NTT)

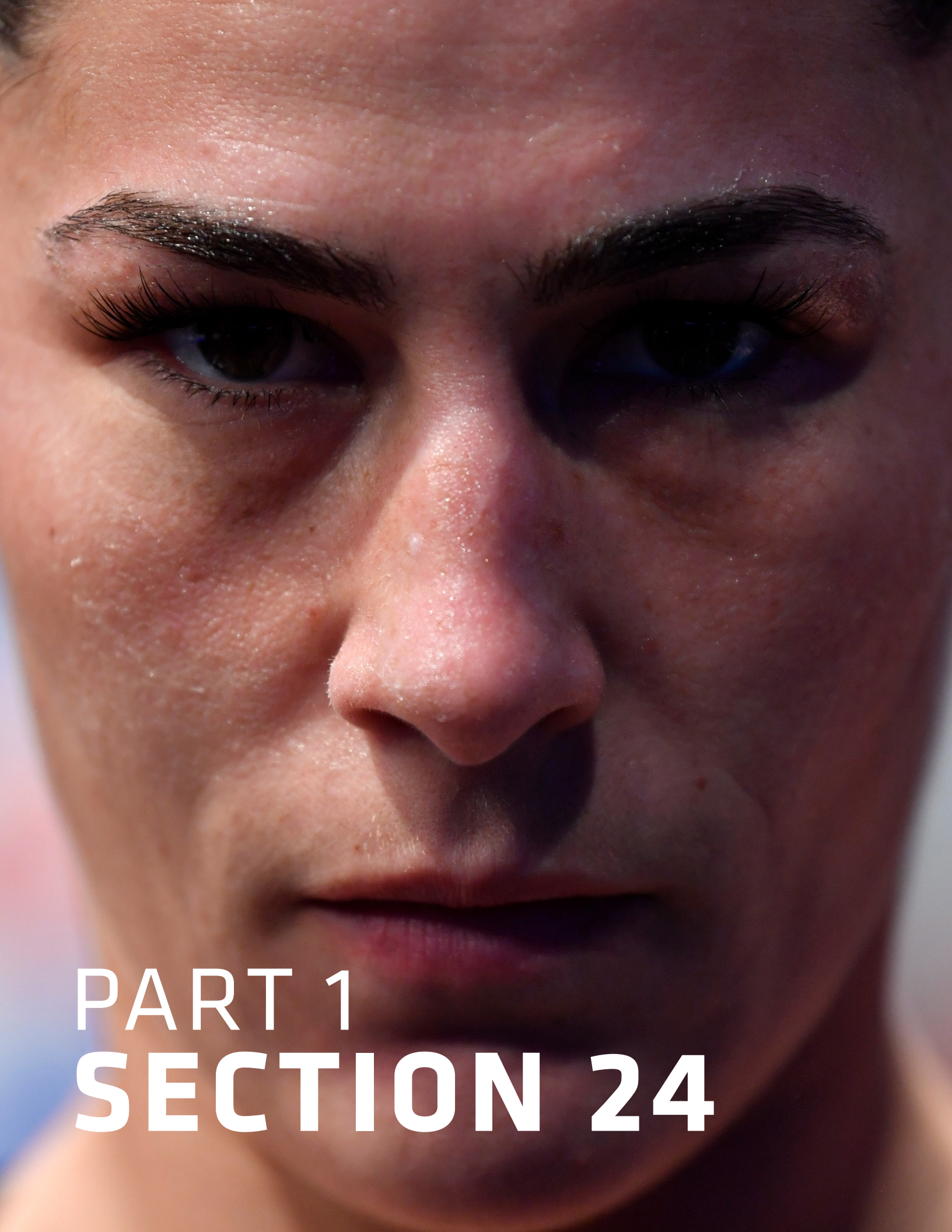
Intensity and duration of session
Type of session (e.g., strength, power, energy system, etc.)
Subsequent training
Desired outcome: strength, power, energy system, etc.
Potential interference effect of recovery modalities (e.g., hypertrophy mitigation)

OFF-CAMP

Focus on maximizing physiological and mental adaptations to training
May be opportunity for heat acclimation

FIGHT-CAMP

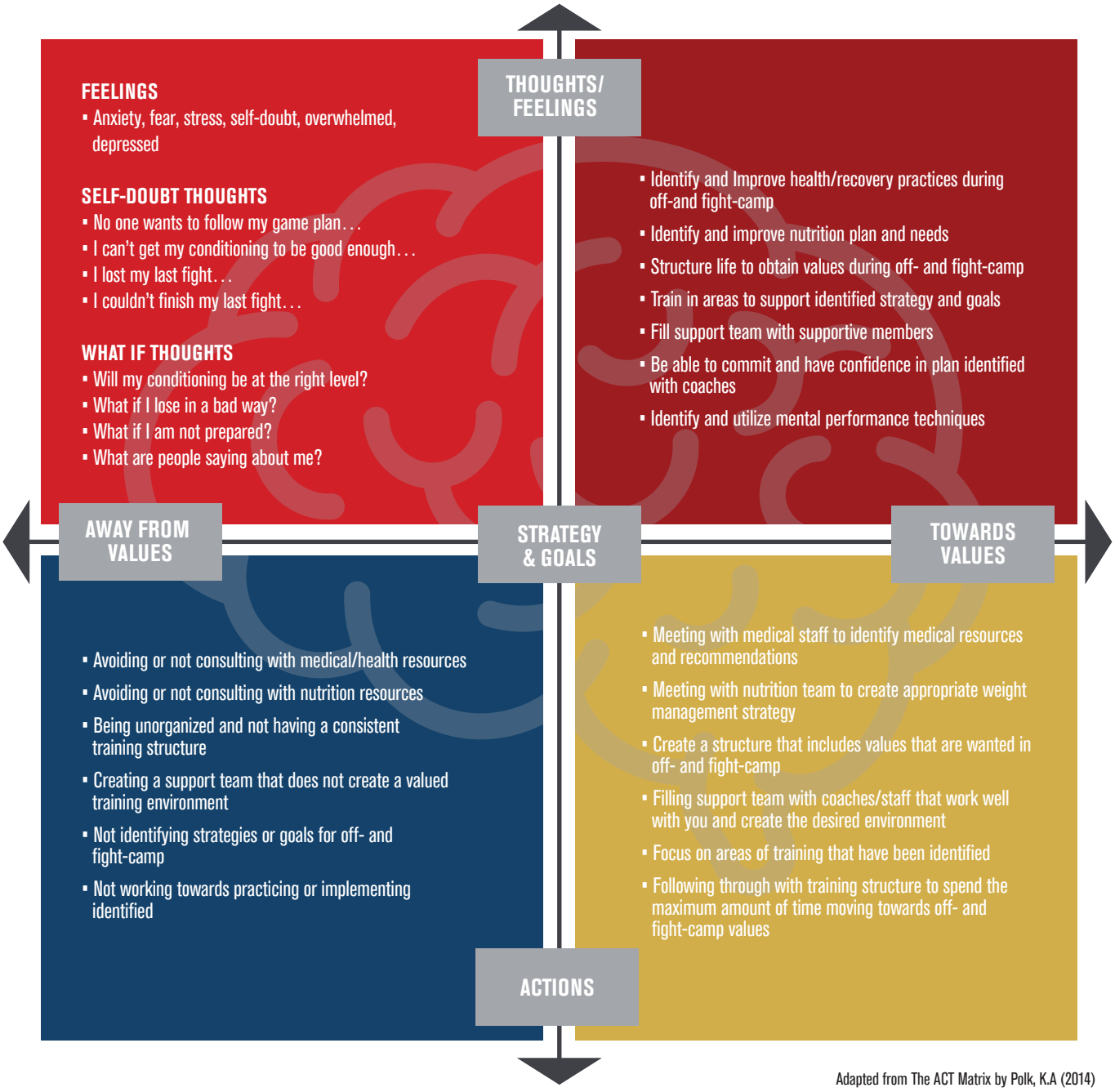
Maximize recovery for peak performance through fight-camp



PART 1
SECTION 24

SECTION 24: FIGHTER PSYCHOLOGY GOALS, VALUES AND CREATING BUY-IN

By Micah Schnurstein and Heather Thanepohn



Adapted from The ACT Matrix by Polk, K.A (2014)

The Acceptance and Commitment Therapy Matrix is a tool that can be used to help athletes label their values and the actions they can take to move toward them. This matrix also helps identify challenging thoughts and actions that lead an athlete away from values they want. It can be used by athletes to identify thoughts, feelings and actions in THIS moment, so that they can see if they are moving toward the values they have identified. This example demonstrates how fighters can use the matrix to create strategy and goals during off-camp and fight-camp.



PART 1
SECTION 25

SECTION 25: REMOTE COACHING TACTICS

By Kyle Larimer and Alexa Eisenberg

CONSULT

Consultations should collect all relevant athlete information:

General: Injury status and history, current weight, athlete schedule, fight status

Strength & Conditioning: Comprehensive evaluation of appropriate physical variables, discuss facilities

Nutrition: Weight history, dietary intake and fueling strategies

Sports Medicine: Ortho/movement screen

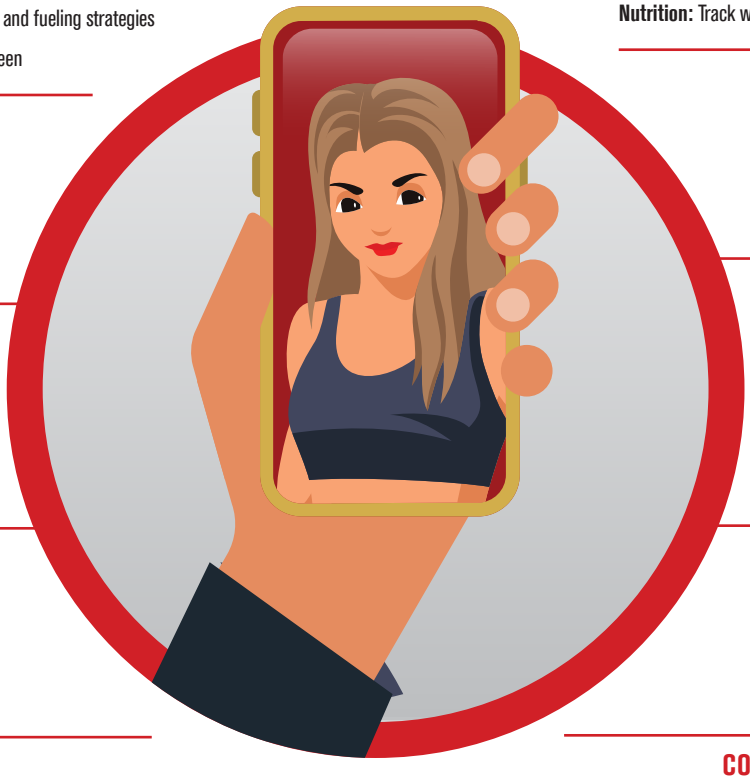
RE-EVALUATE

Whether in person or remotely, objectively track progress:

General: Establish assessments athlete can do on his or her own or schedule, in-person testing whenever feasible

Strength & Conditioning: Target most relevant variables

Nutrition: Track weight and/or recovery



INTEGRATE

Attempts should be made to collaborate, or at least communicate, with appropriate coaches and practitioners:

Especially for remote services, practitioners may be unaffiliated with one another. This can create problems if the services are not integrated. For example, a dietician could be recommending strategies to target weight loss while an strength and conditioning coach is targeting hypertrophy.

COMMUNICATE

Stay connected with athlete regarding compliance and progress:

Program delivery: Develop templates (Excel) or use software to deliver programs

Follow Up: Frequency of contact depends on need and risk of athlete. It can be every few days to bi-weekly. Video can be used to remotely attend sessions or review technique (S&C/PT). Relevant variables should be frequently updated/monitored (e.g., fight status, training schedule, injuries, etc.)

Athletes may not always be accessible in person, or their schedules might not allow them to attend in-person sessions. Furthermore, they may live in a different city, making face-to-face meetings a challenge. Implementing remote services can help ensure the continuation of athlete progression when it otherwise may be disturbed and can allow for more flexibility in schedules that often see practices, workouts, recovery and personal time all competing for limited-time resources. The basic principles provided here are also relevant for local or in-person services but take on new importance when applied remotely. The lack of consistent in-person interaction can require greater effort from practitioners to gather and communicate relevant information, often through different means than those used with local athletes, to ensure programs are up-to-date.

PART 2

OFF-CAMP



SECTION 26: OFF-CAMP PHILOSOPHY

By Joseph Coyne, Dean Amasinger and Forrest Griffin

The overall off-camp philosophy should be guided by two goals that will significantly influence training during this period. These goals are to i) minimize any weaknesses in technical and non-technical training and ii) to build a foundation upon which to build in fight-camp. For the first goal, the identification of technical and non-technical weaknesses will provide the athlete and coach with specific factors that can be targeted to improve performance. However, before you can begin to address or minimize weaknesses, you have to initially identify them (See Part 1). Once the athlete has completed any assessments, the identification of the primary weaknesses or "window of opportunity" relative to their respective weight class should be completed. Coaches and fighters can refer to the appropriate sections in Part 1 to identify where they sit in each assessment relative to the entire UFC roster across weight divisions. An important consideration is although we advocate a fighter's off-camp focus on weaknesses, this focus should not harm or detract from the fighter's inherent strengths. As such, these strengths should be maintained in some way during off-camp.

In keeping with the "52 week camp" philosophy, the off-camp is not only an opportunity for technical and physical development but also to meet and the second goal of the off-camp phase: building a technical and physical foundation that will potentiate fight-camp activities. The goal is designed to ensure the athlete's fight-camp can be devoted to technical training without excessive interference from non-technical areas. A common example of excessive non-technical interference in MMA is a compromised fight performance due to the fighter needing to focus on conditioning or calorie restriction during the fight-camp in order to make weight. Historically, the trend in MMA has been for a fight-camp to have multiple primary focuses including technical and tactical development, weight management and conditioning. Furthermore, off-camp can be somewhat unstructured while the athlete recovers both psychologically and physically from the fight-camp and is not centred around fight-camp potentiation. If the fight-camp has been both physically and mentally draining due to a chronic caloric deficit, additional ESD and the psychological drain of competition, the recovery period can be dramatically extended. This can cause significant detraining, resulting in the athlete returning back to "square one" and a bounce-back effect with regards to weight. Ideally, the fighter is adequately prepared and possesses the required non-technical physical capacities (e.g., strength, endurance) along with being in an appropriate weight range by the end of off-camp (i.e., a weight descent risk score of two or less). This will mean the fight-camp does not need to be devoted to a weight descent beyond reasonable levels, and the primary focus can be on technical and tactical development. To achieve this, it requires a reverse-engineering approach (i.e., planning back from the criteria the fighter would hopefully achieve by the end of off-camp). This reverse-engineering approach is also recommended to minimize weaknesses. Examples of possible criteria to achieve by the end of the off-camp that would adequately prepare the fighter for fight-camp may include a consistent >20 percent one-minute heart rate recovery between sparring rounds for conditioning or an athlete weight within 112% of his or her weight class for making weight. These criteria also depend on the length of the fight-camp (e.g., "Is the fight camp six weeks or 10 weeks?") and also the fighter's history (e.g., "Does the fighter typically lose weight easily over the fight-camp?"). Planning the off-camp around these criteria and monitoring them will help set the fighter up for a successful fight-camp.

"DO THE WORK IN OFF-CAMP SO YOUR FIGHT-CAMP ISN'T A FAT CAMP OR A FIT CAMP!"

These two off-camp goals then need to be filtered into the constraints of the overall training structure. In addition, they may also complement or interfere with one another, depending on the fighter's respective strengths and weakness. For example, a fighter who struggles with weight management but also needs to improve strength levels based on diagnostics may need to include extra conditioning or caloric restrictions to control weight, which would ultimately interfere with achieving strength gains. The off-camp goals should also be balanced with a number of other considerations. These include fighting style (e.g., "How much does a high work-rate grappler want to devote to striking or developing speed in off-camp at the expense of conditioning, which suits their style?"), technical expertise (e.g., "How much does a less-skilled technical fighter want to devote to non-technical weaknesses?") and experience or training age (e.g., "How much will a fighter improve maximal strength if they have been consistently training this quality for many years and it is still weak relative to others in the weight division?"). The off-camp goals also need to be balanced with the common characteristics of off-camp. These characteristics include allowing for a greater focus on the individual components of MMA (e.g., striking or grappling). While always important to use techniques that have relevance to MMA competition, a focus on these individual martial arts components allows a greater attention to detail in perfecting techniques and develops the foundations for tactical MMA work to be built upon. The off-camp philosophy should focus on learning, experimenting and unrestricted creativity (especially around any new techniques being learned) and less competitive than in fight-camp. The assessment of the fighter's last off-camp, fight-camp and fight itself should also be considered. Deciding on how to achieve the off-camp goals and implement them alongside the above considerations is the balancing act and "art" of MMA training and fighter preparation.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PART 2
SECTION 27

SECTION 27: GENERAL PREPARATION: TECHNICAL SESSION PLANNING

By Dean Amasinger and Felix Falkenberg

The off-camp general preparation phase is an opportunity to focus on the individual techniques of the 11 categories that make up the technical skills of MMA (see Section 3). Using skills evaluation to guide training strategy, the focus of general preparation is on development to increase a fighter's technical skills. This is illustrated in the prioritization of training individual skill categories in isolation (e.g., wrestling, kick boxing, jiu jitsu). In line with the aforementioned emphasis periodization model (Section 17), there is still integration of technical categories, but there are a greater number of sessions that focus on one technical category and a limited amount of time spent developing fight IQ or tactics. There should also be a greater emphasis on technical drilling compared to live go's in general preparation. From the non-technical perspective, one of the primary goals relating to physical conditioning is to develop an aerobic base (discussed in more detail in Section 33). This can also be reflected in the format of technical session. When implemented intelligently, extensive drilling and longer duration sessions can serve as an effective way of developing aerobic capacity while enhancing technical ability.

An example general preparation 3-week cycle with different live:drill ratios and target training intensities is shown in Table 27.1 In the general preparation phase, a greater emphasis should be placed on technical drilling compared to live go's and is reflected by a lower live:drill ratio. Furthermore, the coach's intended session rating of perceived exertion (sRPE) for the fighters should also be lower in general preparation vs. specific preparation or fight-camp. Along with the setting of intention, coaches language/feedback and the experimental nature of training, a more relaxed training environment can be created.

TABLE 27.1

EXAMPLE 3-WEEK MESOCYCLE IN THE OFF-CAMP GENERAL PREPARATION PHASE

	OFF-CAMP GENERAL PREPARATION		
	-12	-11	-10
TARGET INTENSITY	MODERATE	HIGH	LOW
COACH INTENDED sRPE	4.3 ± 1.1	4.5 ± 1.0	4.2 ± 1.6
LIVE : DRILL	16% : 84%	18% : 82%	23% : 77%
TOTAL LIVE RD	28	32	26
TT:NTT DISTRIBUTION	75% : 25%	73% : 27%	74% : 26%

Figure 27.1 shows an example flow chart for a technical skill—in this instance a fence wrestling takedown. Each technical area highlighted in the skills evaluation tool (Section 3) has a syllabus flow chart similar to this that shows the technical fundamentals of each area. This is by no means an exhaustive curriculum but rather a representation of how a syllabus can be replicated for all areas of MMA regardless of style or the level of competency. Within a larger curriculum, this individual syllabus (i.e., fence wrestling) can then be used to session plan and monitor what techniques have been covered, as well as the time between "refresher" sessions.


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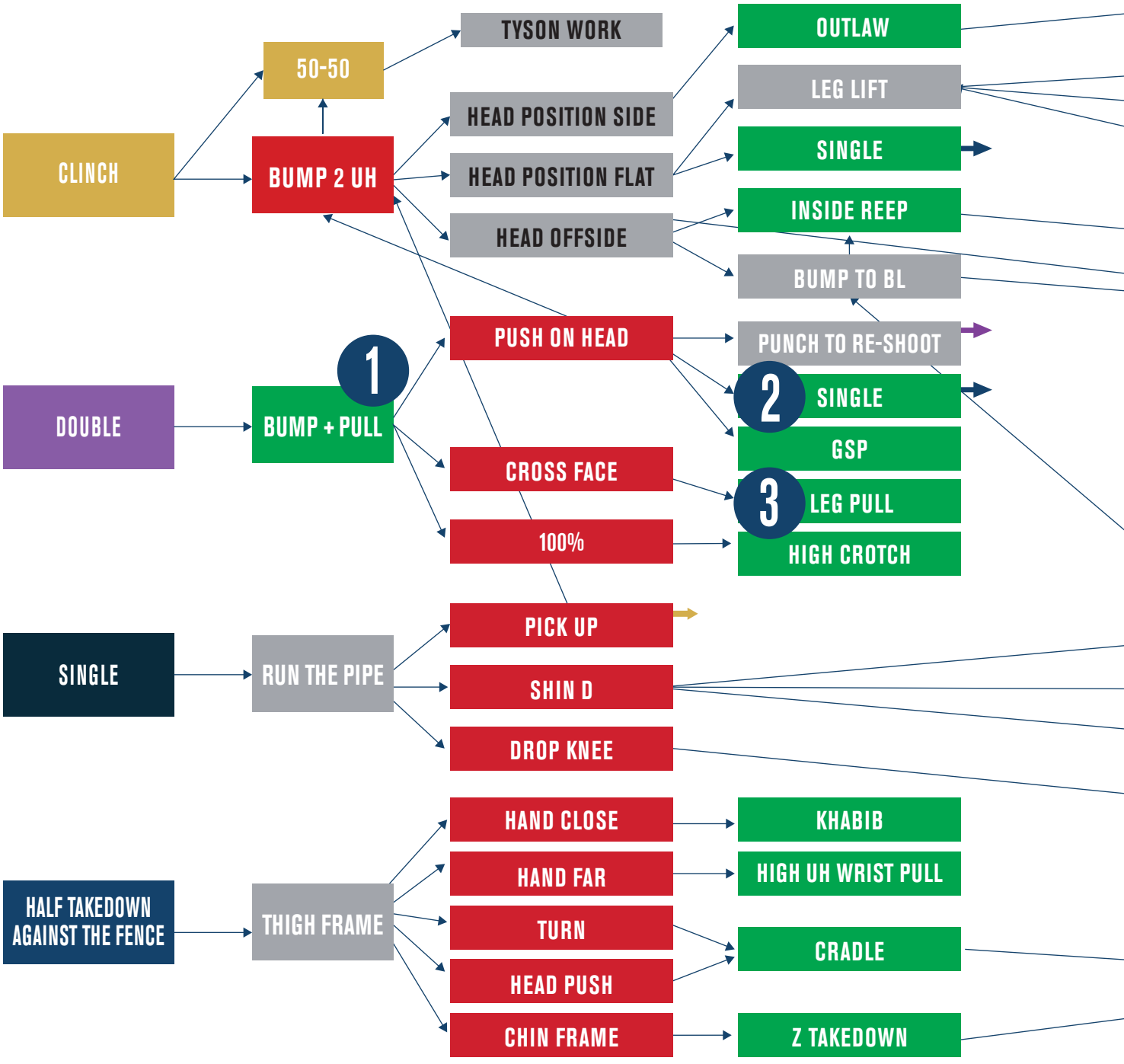
FIGURE 27.1

EXAMPLE OF A SYLLABUS FLOW CHART FOR THE FENCE TAKEDOWN TECHNICAL STREAM IN MMA



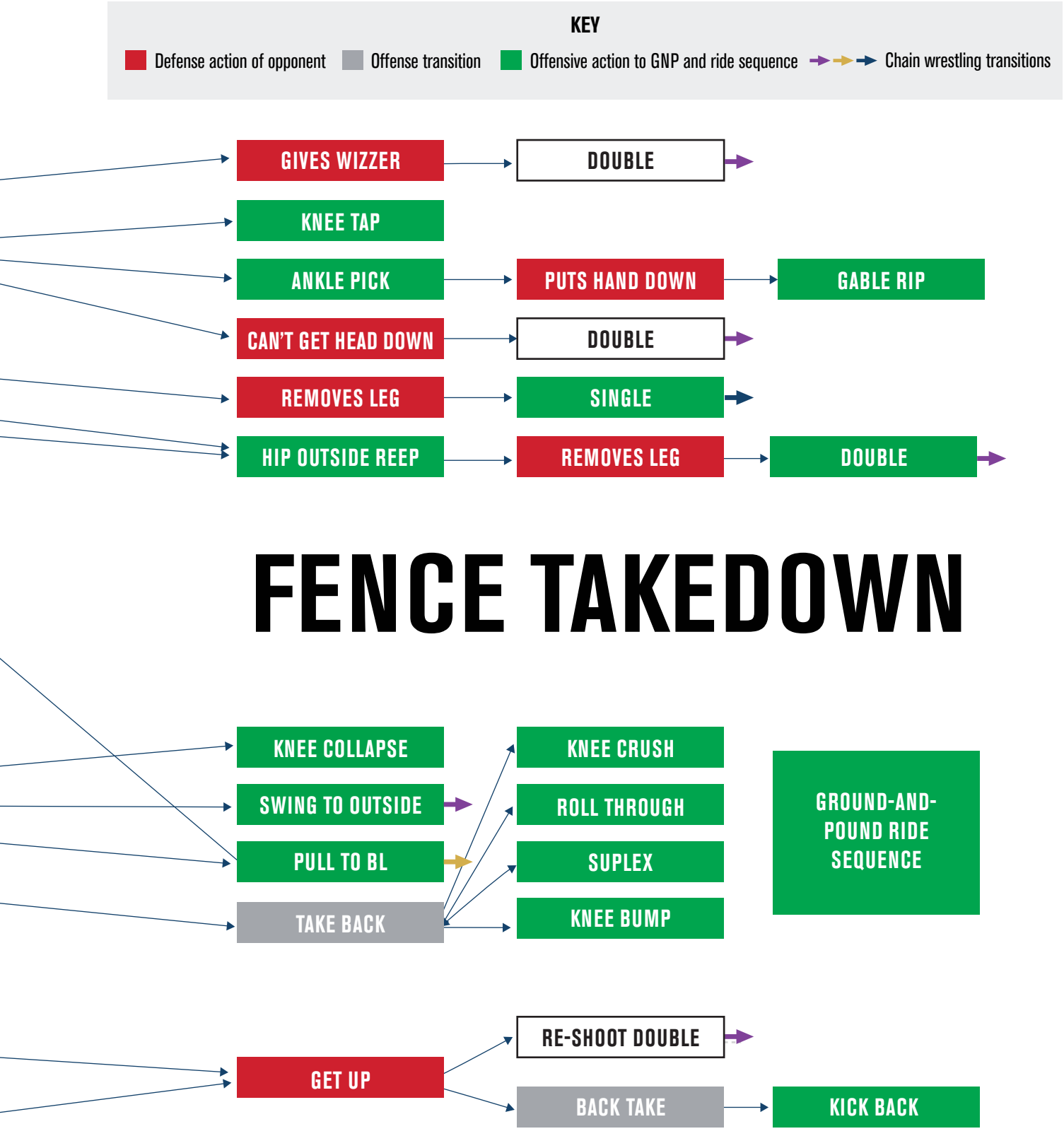

KEY
Defense action of opponent
Offense transition
Offensive action to GNP and ride sequence
Chain wrestling transitions
GIVES WIZZER
DOUBLE
KNEE TAP
ANKLE PICK
PUTS HAND DOWN
GABLE RIP
CAN'T GET HEAD DOWN
DOUBLE
REMOVES LEG
SINGLE
HIP OUTSIDE REEP
REMOVES LEG
DOUBLE
FENCE TAKEDOWN
KNEE COLLAPSE
SWING TO OUTSIDE
PULL TO BL
TAKE BACK
KNEE CRUSH
ROLL THROUGH
SUPLEX
KNEE BUMP
GROUND-AND-POUND RIDE SEQUENCE
GET UP
RE-SHOOT DOUBLE
BACK TAKE
KICK BACK


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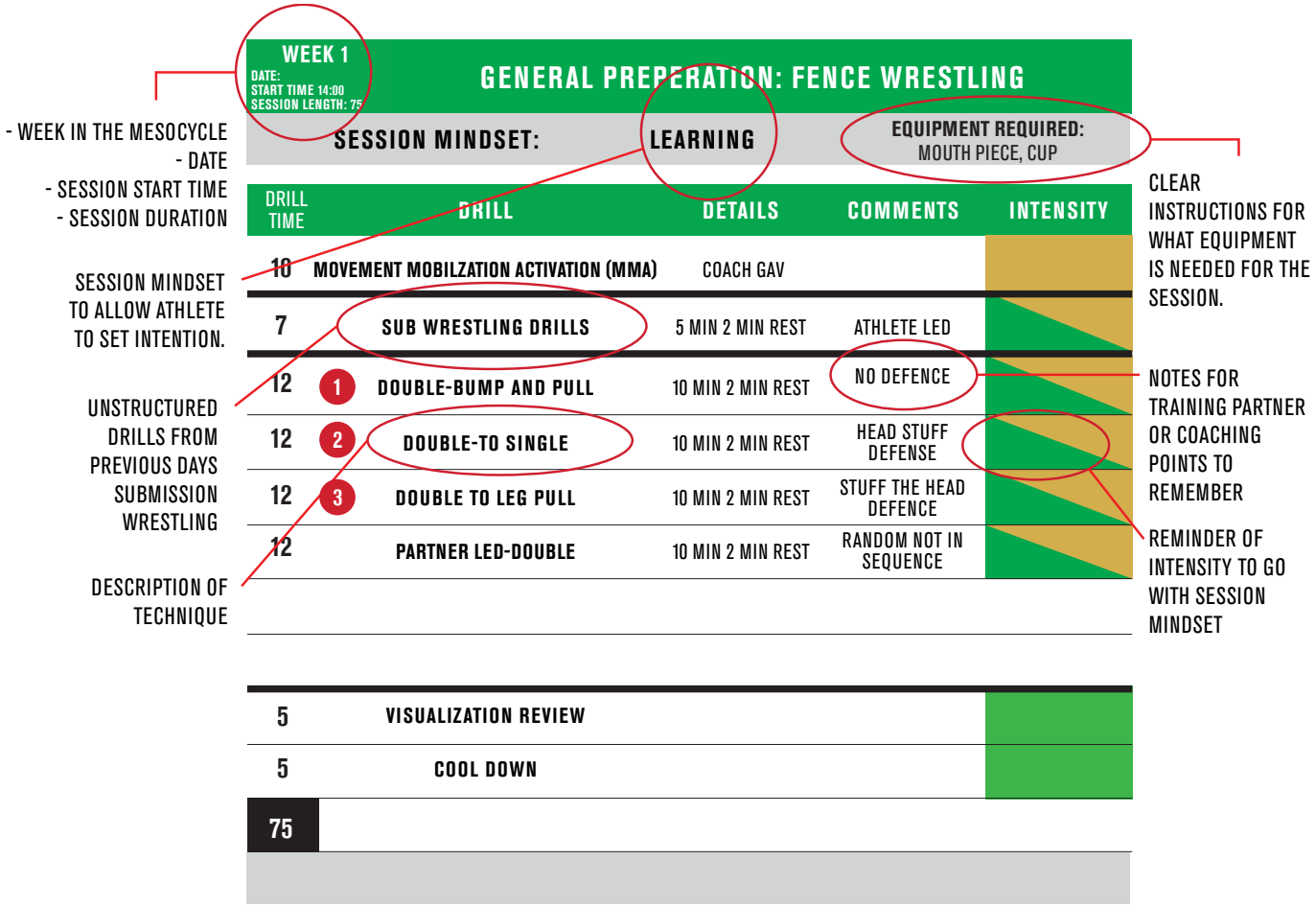
FIGURE 27.2

EXAMPLE LOW-MODERATE INTENSITY FENCE WRESTLING TRAINING SESSION

(COACH INTENDED SRPE 3)



The flow chart shows how techniques are connected and allows a road map to be created that ensures intercordiation of technical categories between microcycles. The names used for particular techniques in the syllabus are not important and can be specific to any coach, system or gym, particularly until the nomenclature for MMA has been agreed upon. The bold numbers 1,2,3 in red represent the path that can be taken through the flow chart and represents a fence wrestling session that is detailed in Figure 27.2 below.

The example shown in Figure 27.2 is a session plan for a low-moderate intensity fence wrestling session. There are is no "live" aspect to the session, and the long continuous rounds are suited to drilling and getting adequate repetition of the technique. This also allows for a high volume of coaches' feedback, both during the round and in rest periods. The template can be used to construct, monitor and record training at any phase of camp. It allows a record of the training history both in terms of volume and of the techniques used from the syllabus. This can then be referred back to and evaluated against whether there have been discrepancies between coach intended volume/duration (e.g., training ran long by 45 minutes) or intensity (e.g., the athlete's sRPE was significantly lower than what the coach intended).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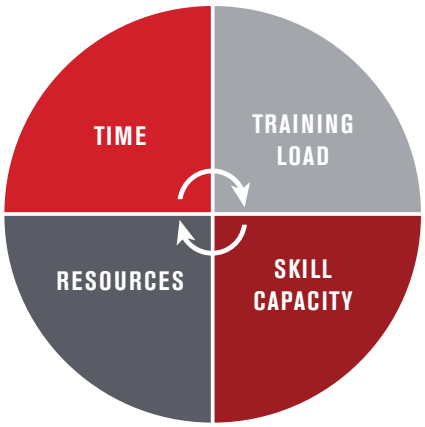
PART 2
SECTION 28

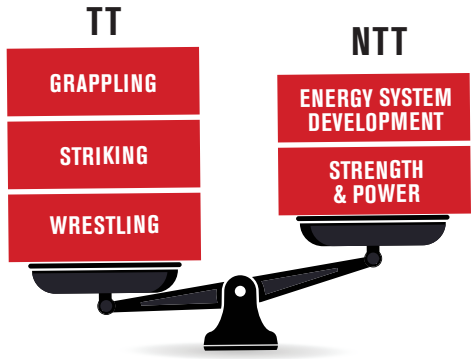
SECTION 28: MANAGING ATHLETE NUMBERS

By Gavin Pratt and Dean Amasinger



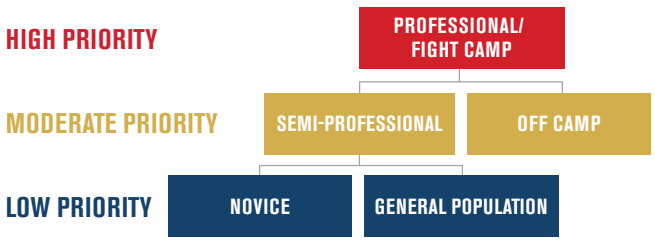
CYCLE OF CONSIDERATIONS

Planning effective and efficient training sessions for multiple fighters simultaneously requires a high level of thought for technical and non-technical training staff. There are a number of factors that need to be addressed (outlined in the Cycle of Considerations) prior to each training phase (meso-cycle), week (micro-cycle) and daily session, to ensure each athlete receives the greatest amount of individual development possible—even when in a group environment. Ideally, these factors should be discussed regularly between technical and non-technical training staff to effectively manage groups of fighters.



TRAINING LOAD

Managing training load via subjective measures (e.g., sRPE) is simple and effective and gives coaches greater insight into the perceived training intensity of each individual. This is especially relevant with low coach:athlete ratios, where coaches do not have the same opportunity to individually monitor an athlete. This information can then be used to determine the intensity of future training sessions to avoid overtraining. Objective training load measures (e.g., heart rate, velocity-based training) are easier to implement with high coach:athlete ratios.



SKILL CAPACITY

Prioritize training around the technical requirements of higher-level athletes or those in fight-camp. Implement skills of greater complexity in technical and non-technical training when a lower number of athletes are in attendance. This will improve skill development across all levels during group training. Often, the drill can be modified easier for lower skill set athletes than increasing complexity/ intensity for higher skill set athletes



RESOURCES

Floor space, equipment, and the coach:athlete ratio should be considered when selecting drills/training modalities. The more technical and coach-led a session is, the lower the coach:athlete ratio needs to be. As such, in MMA, recommended coach:athlete ratios may vary greatly, especially in technical training. For instance, the proximity to a fight plays a role and the nearer the fight becomes, the more time 1:1 or 1:2 ratios are needed. Alternatively, when athletes are drilling techniques, they are competent in the ratio can be as high as 1:30. Meanwhile, for non-technical training, a maximum 1:6 coach:athlete ratio is generally recommended.

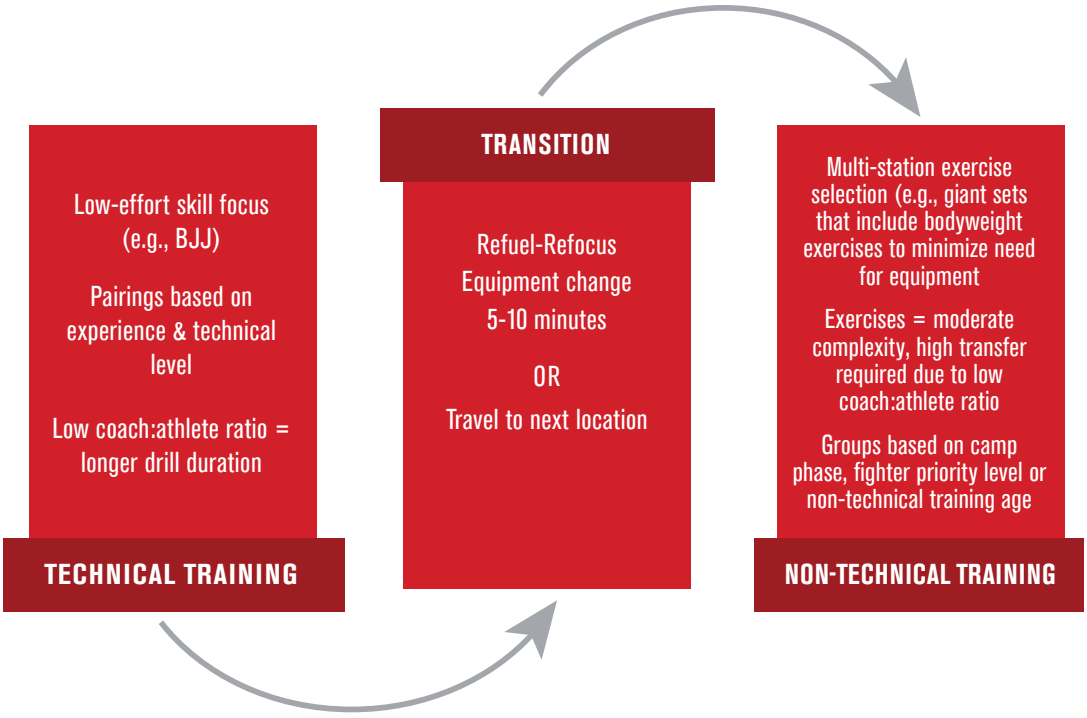


INDIVIDUAL TRAINING REQUIREMENTS

TIME

To optimize individual results, bucket fighters into groups based on testing analysis. This can be done within both technical and non-technical training, depending on chosen outcomes. It is important to plan the frequency/duration required for desired adaptation to occur.

EXAMPLE OF A TRAINING SESSION WITH A LOW COACH:ATHLETE RATIO (LARGE ATHLETE NUMBERS)





EXAMPLES OF MANAGING ATHLETE NUMBERS: LOW COACH:ATHLETE RATIO (LARGE ATHLETE NUMBERS)

TYPE	TRAINING LOAD	SKILL CAPACITY	RESOURCES	TIME
DESCRIPTION	Desired: Low to Moderate Intensity	Required: Low to Moderate	Environment: Minimal equipment & floor space	Duration: 60 minutes each for technical and non-technical training
TECHNICAL TRAINING	Use sRPE to determine whether desired intensity was reached or surpassed.	Low complexity suited to the requirements of high-priority fighters.Longer drill durations	Lower technical focus due to low coach: athlete ratio, minimal live work/sparring due to low floor space	Bucket/pair athletes based on skill level. This ensures skill development is maximized even at low to moderate skill requirements
NON-TECHNICAL TRAINING	Use RPE and sRPE to determine if load/volume parameters were appropriate to desired output.	Avoid maximal loads that require spotters or complex exercises (e.g., Olympic lifts) due to low coach: athlete ratio. Include regressions of exercises for athletes with low training ages.	Use combinations of loaded movements and body weight exercises to create efficient use of training floor space and equipment.	Prescribe multi-station scenarios (e.g., French Contrast method or giant sets) to maximize effectiveness. Bucket athletes by training age, skill capacity, camp status (then prescribe accordingly) or integrate the different levels to use more experienced athletes as "technical assistants."

EXAMPLES OF MANAGING ATHLETE NUMBERS: HIGH COACH: ATHLETE RATIO (LOW ATHLETE NUMBERS)

TYPE	TRAINING LOAD	SKILL CAPACITY	RESOURCES	TIME
DESCRIPTION	Desired: High Intensity	Required: Moderate to High	Environment: Large amount of equipment and floor space	Duration: 90-120min for Technical Training and 75-90min for Non-Technical Training
TECHNICAL TRAINING	In addition to subjective measures, use wearable technology (e.g., heart rate monitors, inertial measurement units) to track individual responses and output.	High-level complexity suited to requirements of high-priority fighters.	High coach:athlete ratio allows for high technical focus and more live work and sparring.	Longer time frames allow more detail on technical components and for fighters to practice them in live scenarios.
NON-TECHNICAL TRAINING	In addition to subjective measures, use technology (e.g., velocity-based training and heart rate monitors) to guide daily loading and fatigue within session.	Include exercises suited specifically to individual requirements. Level of complexity guided by individual fighter's skill capacity.	Prescribe exercises to take advantage of available equipment and maximize training adaptations. Ensure program creates an efficient and effective "flow" between equipment.	Individualize programming to suit needs of individual (e.g., force or velocity deficiency). Ability to include more individualized remedial or sports performance related prescriptions.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PART 2

SECTION 29

SECTION 29: GENERAL PREPARATION: TECHNICAL SKILL DEVELOPMENT

By Dean Amasinger

The approach to skill development in general preparation can vary greatly depending on the technical competency and level of experience of the athlete. A fighter's technical competency will guide what is best suited for them in this period (e.g., a kick boxer taking the time to learn defensive wrestling). For the purpose of this journey through skill development in this section and the following chapters, the assumption is that Athlete X is a novice professional (5 to 10 fights). Although the constraints-led approach is one of the most suited to MMA skill development, during general preparation, a form of deliberate practice can also be appropriate. The method of deliberate practice can be applied to MMA skill development in athlete-coach settings by creating a version of it that doesn't always meet all the criteria of deliberate practice but meets the needs of the sport. In team-coach settings, it may best be described as purposeful practice. There are several considerations when trying to develop skill, including the enjoyment level of the training, coaches' feedback, goals of the training session, athlete choice, complexity of the motor skill involved, skill decompression between sessions, recovery between sessions and the unique individual-team nature of MMA. There are many reiterations of that individual-team structure from the big mega gyms and the implications of athlete pecking order to camps that are centered around one athlete with a select group of training partners. The following example of the progression through the training phases around one technical stream will be under the system used at the UFC PI in Shanghai.

As mentioned in Section 18, the progression of skill development should be systematic in nature. To accomplish this, a coach should have a clear MMA curriculum that athletes should be competent in, have a good understanding of his or her fighter's current technical competence (Section 3) and an efficient method of logistically organizing their training to cater for skill development needs (e.g., a session plan, micro-cycle (e.g., 1 week) and meso-cycle (e.g., 3-4 week) structure).

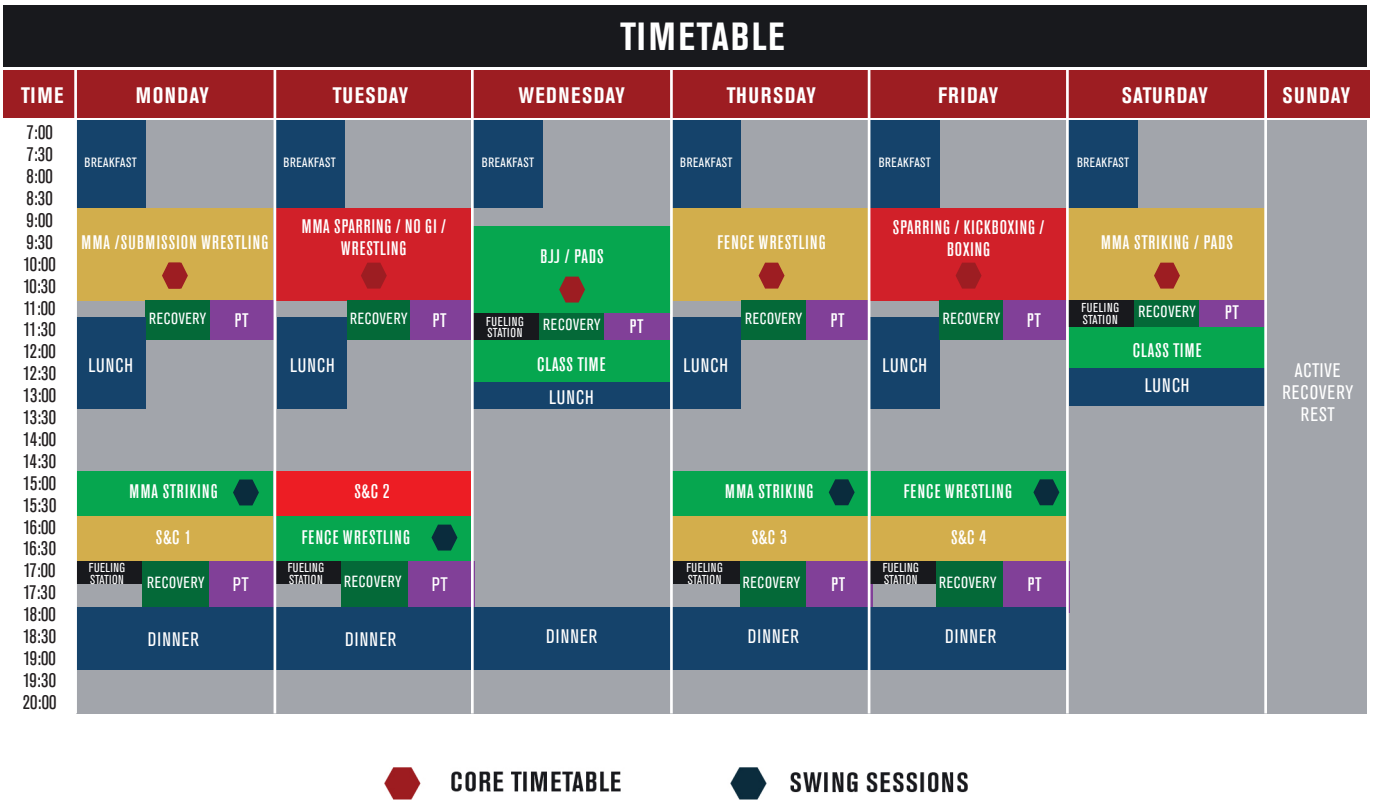
As mentioned in Section 14, the systems-based approach looks to structure the progression of skill development. For optimal skill development across all phases of a fight preparation, we suggest an MMA micro-cycle structure that has both core and swing training sessions. The core timetable within a micro-cycle should reflect an even spread of the MMA curriculum and aims to develop a well-rounded technical competence regardless of fighting style. Oppositely, the swing sessions reflect optional sessions within the micro-cycle that are connected during a mesocycle of training. These swing sessions are dependent on fighter style and the focus of which comes from the technical evaluation, fight review and the phase of fight preparation. In general, preparation swing sessions are normally focused on technical factors that need attention (i.e., techniques with lower technical competence).

TECHNICAL THEMES AND INTRA-COORDINATION OF TECHNICAL STREAMS

Within a three-week mesocycle there are technical themes that structure the technical focus of the micro-cycles. For example, in one micro-cycle, the technical theme may be the double-leg takedown. In this case, all technical sessions will have some connection to the double-leg takedown. Using the example from Table

TABLE 29.1

A SAMPLE MICRO-CYCLE STRUCTURE IN GENERAL PREPARATION



29.1 the Day One submission wrestling session could be focused on double-leg defense and counters. The Day Three BJJ session could be focused on side-mount control and submissions from side mount (as side mount is one of the most likely position to end in after a successful double-leg takedown). This takes a high level of coordination between technical coaches to not only maintain the prescribed training load but also to facilitate the intra-coordination of the technical theme. This intra-coordination is a guideline and not a strict rule. If individual coaches see a need to work on other areas that are not directly connected to the technical theme then they have that freedom to do so. However, it is a guiding principle to help structure the technical-tactical sessions. In keeping with the general preparation technical ethos, striking sessions should emphasize individual techniques and the detail around efficiency and force production.

As shown in Figure 27.2, the fence wrestling session included an athlete-led warm up that recalled the drills from submission wrestling session the day before. This is an effective way of creating stronger neural pathways by engaging recall of the skill in a non-linear way and allows the coach another opportunity to gauge the fighter's learning progress and make any adjustments if needed. This session is a GP approach to skill development in that it has low contextual interference but has relevance of practice. In Athlete X's technical analysis, fence takedowns were identified as an area of low technical capacity. In this example, there are three sessions in the week that focus on that technical stream. The first session lays the foundation of the techniques. This means high-volume coach instruction and feedback with an emphasis of internal cues and a process focus as the technique is described and high reps as the athlete finds his or her way through the coaching points. The second fence wrestling session is a review of the techniques from the first session but has less instruction and feedback and an element of live go's to test the positions against an opponent and manipulate the constraints and increase the contextual interference. The third session is another review but focuses on challenges highlighted by the athlete in the post-session review of session 2 and technical points picked up by the coach that presented themselves in the live aspect of the session. This level of skill exposure and development across meso- and micro-cycles requires a high level of logistical planning, fighter observation and, most importantly, coordination between coaches in order to facilitate.





PART 2
SECTION 30

SECTION 30: GENERAL PREPARATION: SPARRING CONSIDERATIONS

By Forrest Griffin, Richy Walsh, Dean Amasinger and Felix Falkenberg

Sparring is an integral part of developing the technical and mental skills required for success in MMA. A coach may use sparring to gauge where a fighter is in his or her development (i.e., strengths and weaknesses) and if a fighter is able to integrate recently learned techniques in live situations. It is common for coaches to design the training week around sparring and we recommend there should be a minimum of 48 hours between sparring. Sparring can also provide feedback for both coaches and fighters on the effectiveness of tactics and specific game plans. Ideally, sparring should attempt to recreate key areas of a fight in a controlled environment and may be either full MMA rounds (i.e., five minutes) or isolated situational or positional efforts. Because of the nature of MMA, it is unreasonable and unsafe to expect athletes to spar at a very high intensity throughout the full duration of fight preparation. Sparring intensity can be dependent on multiple factors which include partner selection, order and weight classes along with the length of rounds, rest periods and level of agreed sparring (See Table 30.1 which details different levels of sparring intensity). All of these will affect the total intensity of the sparring.

The various stages of a fight cycle (e.g., off-camp, fight-camp) and the goals of each of these stages (i.e., general preparation, specific preparation, fight-camp) will help identify the type and intensity level of sparring in a fight preparation. For instance, the aim of some sparring sessions in general preparation may be to implement new techniques and test conditioning as opposed to "winning the round" in fight-camp. Having an agreed upon scale of reference (as in Table 30.1) for coaches and fighters to moderate sparring intensity will help limit the risk of injury in fight preparation. Another key reason for having different levels of sparring intensity in fight preparation is skill development. As the nature of sparring and the competitive mindset of fighters can sometimes be a roadblock to learning, moderating sparring intensity can manage any fear and hesitation that comes with more competitive sparring sessions and allows athletes to attempt new techniques and tactics and build confidence during sparring. Different levels of sparring intensity also give coaches a greater opportunity to understand a fighter's strengths and weaknesses in different areas of MMA while under duress— but without bringing them to a breaking point or excessively risking injury. Coaches can also use a tactic we call "pre-framing" to help gauge a fighter's strengths and weaknesses during sparring.

PRE-FRAMING

Instruction-giving to a sparring partner by a coach or fighter to work on a technical weakness, replicate an opponent's style or create situations that will likely occur in the upcoming fight. For example, a coach may say to a fighter's sparring partner, "I need you to look for the takedown more often today to match his upcoming opponent." Or, "Try to maintain boxing range with as much punching volume as possible because his boxing defense needs work."

INTENSITY

It should be noted that intensity in sparring can be manipulated in two different ways by coaches and fighters. First, it can refer to the work-rate of the fighter (e.g., strikes per minute), and secondly, it can refer to the power of the techniques (i.e., intent to damage sparring partner) used during sparring.

TABLE 30.1

LEVELS OF SPARRING INTENSITY

FIGHT		**ACTUAL FIGHT:** A LEVEL THAT CAN ONLY BE REACHED IN A FIGHT ENVIRONMENT. RESERVED FOR COMPETITION. HIGH RISK OF INJURY.	4 OZ GLOVES	WINNING
LEVELS OF SPARRING	**DESCRIPTION**	**GUIDELINES**	**EQUIPMENT**	**EMPHASIS**
5 FIGHT SPAR	Limit total volume per session to 3-5 rounds. Fight day mindset routine/warmup. Awareness of consequences is high. Must be coach monitored. No techniques that can permantaly damage partnes e.g., oblique kicks.	▪ Heavy punches to head. No follow up. (standing) ▪ Controlled punches to the head on the ground) ▪ Full power low kicks ▪ Controlled kicks to head ▪ Heavy knees (to body) ▪ Full power kicks to body ▪ Controlled elbows (standing and on the ground) ▪ Full power body punches	▪ 16/14 oz gloves ▪ Shin guards ▪ 16/14 oz gloves ▪ Shin guards	Winning
4 HARD SPAR	Agread upon level of power to the head. No slams. Partners should be similar skill level, size and fitness. Monitored by coach. Intensity and intent are high.	▪ Controlled punches to the head (standing and on the ground) ▪ Controlled kicks to head ▪ Full power low kicks ▪ Full power kicks to body ▪ Controlled knees (to body) ▪ Full power body punches ▪ Controlled elbows (standing and on the ground)	▪ 16/14 oz gloves ▪ 8 oz gloves ▪ Shin guards ▪ Elbow pads ▪ Knee pads	Competitive
3 SPAR	Sense of risk is moderate. Controlled spinning attacks. This is where technical errors are expected as new techniques are intergtated.	▪ Controlled punches to the head (standing and on the ground) ▪ Controlled kicks to head ▪ Full power low kicks ▪ Controlled kicks to body ▪ Touch knees (to body) ▪ Controlled power body ▪ Controlled power body punches ▪ Touch elbows (standing and on the ground) ▪ Do not allow full body weight to land on partner during takedowns	▪ 16/14 oz gloves ▪ 8 oz gloves ▪ Shin guards	Experimental
2 TECHNICAL SPAR	Learning mindset. Do not make partner pay for being out of position.	▪ Controlled punches to the head (standing and on the ground) ▪ Touch low kicks ▪ Controlled kicks to body ▪ Touch knees (to body) ▪ Controlled power body punches ▪ Touch elbows (standing and on the ground) ▪ Move to positon instead of landing on partner.	▪ 16/14 oz gloves ▪ 8 oz gloves	Learning
1 TOUCH SPAR	All speed, no power. Focus on movement, foot work and technique, not power. Can pratice with little consequence of mistakes. Partners must treat touches as they would a real power strike.	Touch strikes to head, body and legs/ Takedowns; Standing seeeps, trips no throws.	▪ 4 oz gloves ▪ or no gear	Playful

The levels based approach gives Coaches and Athletes a reference for desired sparring intensity. Levels of sparring in Off Camp will generally range from levels 1-3 to further emphasize 'learning' and development. During Fight Camp Levels 3-5 are used to emphasize a more 'competitive' and 'winning' focus.

The equipment list is a recommendation and will change depending on weight class, fighter and availability of protective gear, i.e. elbows and knees could still be utilized without pads in level 4-5 but would be adapted to touch knees/elbows.


PERFORMAN
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TABLE 30.2
GENERAL PREPARATION SPARRING RULES OF ENGAGEMENT

LEVEL	DESCRIPTION
VOLUME	General preparation allows a fighter's sparring capacity to be built up through increasing volume
INTENSITY	In most cases, the intensity level should be low (levels 1-3) and should be at a level to allow upskill and learning without fear or hesitation.
TECHNIQUES	Fighters are encouraged to incorporate recently learned techniques in sparring to foster a learning mindset. Also encouraged to work on their weaknesses and add to their skillset.
CLOCK DISCIPLINE	It is not necessary to stick to strict rest periods in between rounds. Inbetween sets of different sparring modes (e.g., between boxing and kickboxing or big-glove and little-glove sparring rounds), rest periods can be intelligently utilized.
SPARRING REVIEW	Used by coach and athlete to isolate areas of improvement ie., "What can we identify to fix before next sparring session?" Consider using subjective (i.e., coaches' notes) and objective feedback (i.e., video).
SPARRING PARTNERS	Not strict and is a chance to train with different shapes, weight classes, etc. This is possible because of low sparring levels. However, once sparring intensity increases, training partners should be chosen carefully.
PRE-FRAMING	Prioritize pre-framing designed around situations, recently learned techniques and technical weaknesses. Focus on individual arts and isolated sparring efforts.

With the focus on technical improvements, sparring in individual MMA components (e.g., striking, grappling) should also be prominent during general preparation. As the general preparation progresses, the complexity of sparring, as well as the intensity, should increase similar to with other technical and non-technical components. For examples of increasing complexity in sparring within individual MMA components, grappling can become ground-and-pound/get-up rounds, wrestling can become clinch sparring/fence wrestling and boxing and kickboxing can become full MMA rounds. These individual MMA components can also be placed in positional or situational sparring efforts (e.g., seated with the back against the fence, turtle position, or double underhooks). For optimal skill development as mentioned in Section 31, coaches should also consider the current content being taught during training and incorporate this into sparring where appropriate (e.g., if Monday's session taught grappling techniques, the next sparring session would provide an opportunity to isolate that grappling component in sparring). By manipulating sparring in this manner, a coach can devote more time to a fighter's MMA technical area of weakness than they would if always sparring at full intensity. For instance, we often see high-level fighters who can keep sparring rounds in their strong areas but do not develop their auxiliary areas (e.g., a competent striker with good takedown defense will rarely practice get-ups in sparring). Therefore, it is imperative that positional and situational sparring is incorporated not only during fight-camp but also during the off-camp for technical improvements.





PART 2

SECTION 31

SECTION 31: GENERAL PREPARATION: NON-TECHNICAL PROGRAM DESIGN

By Gavin Pratt

Appropriate non-technical training programs for MMA athletes have been shown to yield greater results in speed, strength, power and aerobic fitness than regular or general training programs. To begin designing an appropriate non-technical training program during general preparation we need to ask, "What is the purpose of this phase?" In this case, the purpose throughout off-camp general preparation is to develop fundamental physiological qualities that can be built upon within the specific preparation phase and the fight-camp, and then expressed positively during competition (Figure 31.1). Planning appropriate non-technical training requires reverse engineering, or working backward, from an anticipated or desired fight date (even if this may be unknown during off-camp) and then structuring this time accordingly to develop the physical qualities required for What It Takes To Win (WITTW).

FIGURE 31.1
THE FIGHT PERIODIZATION CONTINUUM - GENERAL PREPARATION PHASE



Inappropriate planning during this time could result in a missed or premature "peak" in performance, in which the fighter is not competing at his or her best during a fight. It should also be mentioned that non-technical training acts predominately as a support mechanism for technical training. As such, non-technical training programming must be integrated with technical training to ensure the optimal development of a fighter to avoid excessive fatigue or overtraining. Planning and communication with the technical coaches is essential for non-technical staff (primarily strength and conditioning coaches) to achieve this integration, as the potential exists for every session to be of maximal output from the athlete if training intensities and volumes are not previously discussed between all the fighter's support staff. This will help a strength and conditioning program accentuate, and not diminish, skill acquisition.

Understanding how to develop the required physiological qualities needed during general preparation should be primarily based on results in any assessments and diagnostics (see Section 4) and then blended appropriately within programming prescriptions required for that individual (e.g., hypertrophy, maximal strength, strength endurance). This also needs to be considered within a fighter's overall training structure, along with his or her injury history and anthropometrics. The importance of each factor within program design is represented in

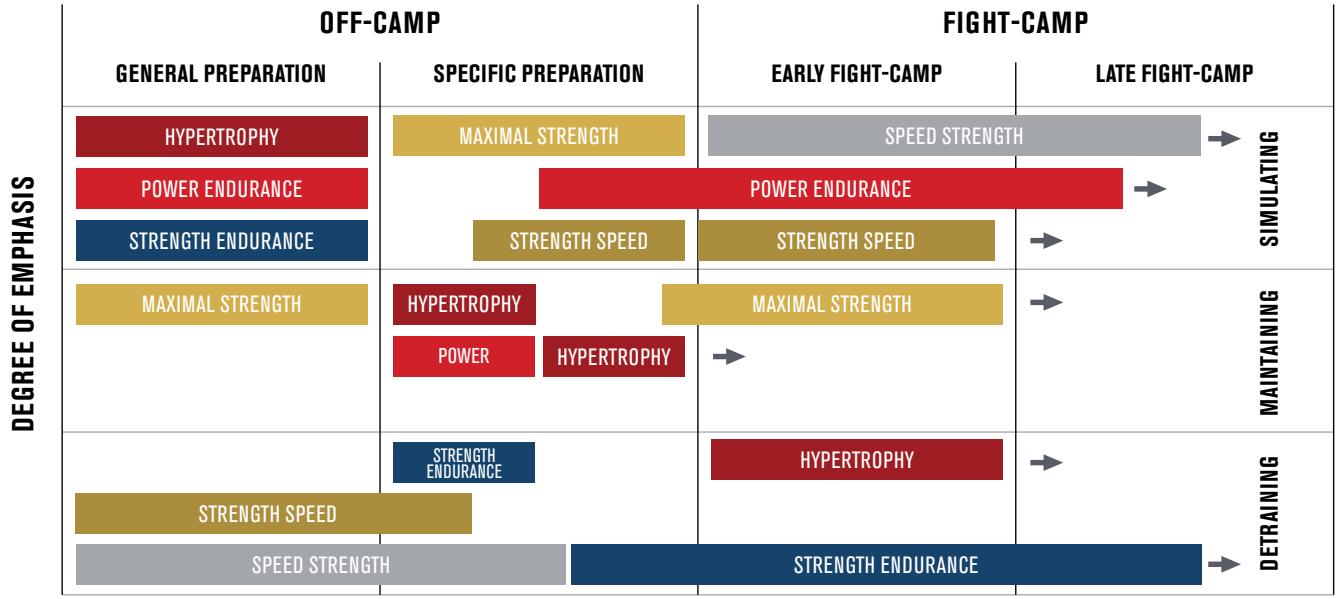
Figure 31.2. Results from any assessments and their diagnostics identify the individual fighter's weaknesses compared to his or her weight division, and the strength and conditioning coach can then begin the process of "filling these gaps" during the general preparation phase. In addition, when individually analyzing a fighter, consideration also needs to be given to his or her background skillset, such as having a striking or grappling dominance.

Other factors that might influence non-technical training design in general preparation include a fighter's personality, his or her culture, body mass compared to weight division (e.g., hypertrophy may negatively impact future weight cuts), gender (e.g., female menstruation cycles), previous injuries, biological and chronological training age and the coach-to-athlete ratio (i.e., how many athletes the coach will be required to manage during the session). All these components should be considered and communicated between both non-technical and technical staff to align the general preparation training focus and better prepare the athlete for the ensuing specific preparation phase and fight camp. Figure 31.3 provides a schematic representation of how different training emphasis can be distributed throughout the various training phases.

FIGURE 31.2
PROGRAM DESIGN CONSIDERATION PYRAMID



FIGURE 31.3
EMPHASIS PARADIGM

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PART 2
SECTION 32

SECTION 32: GENERAL PREPARATION: STRENGTH & POWER DEVELOPMENT

By Gavin Pratt

A key component of the general preparation non-technical training program is strength and power development. The strength and power emphasis within general preparation will generally aim to enhance maximal strength, strength-speed and/or strength-endurance capacity. Improvements in these components will improve a fighter's maximal and repeated force production. This can then be leveraged into greater power production in later phases of a fight preparation (e.g., specific preparation) by implementing more velocity-based training. As a fighter develops greater strength and power training experience, he or she may require more specific emphasis on developing deficient components of the power equation (e.g., more force or velocity) to enhance power output within general preparation. Planning strength and power training within a week also requires consideration of how technical training is structured, so that any non-technical training a fighter completes has as little interference on sporting skill development as possible. This will help moderate athlete fatigue, which in turn, decreases the risk of injury.



Figure 32.1 illustrates a force-velocity decision tree, highlighting how a strength and conditioning coach could create greater specificity within their training prescriptions. For example, a force-deficient fighter will need to favor maximal strength-based prescriptions to yield the best power improvements both now and later in a fight preparation. This fits in with the normal emphasis for general preparation (i.e., enhancing maximal strength and strength-endurance capacity.) However, a velocity-deficient fighter would likely look to maintain current strength levels while incorporating some power-speed characteristics prior to the ensuing specific preparation phase, where holistic programming is more aligned to high-tempo work.

After identifying the strength and power qualities that require development in general preparation, we must identify the best loading parameters to achieve these adaptations. Table 32.1 outlines loading parameter prescriptions to develop different strength and power qualities for MMA fighters. For example, a fighter with a high force deficit would predominately use maximal strength and strength-speed prescriptions in general preparation.

FIGURE 32.1
FORCE-VELOCITY DECISION TREE

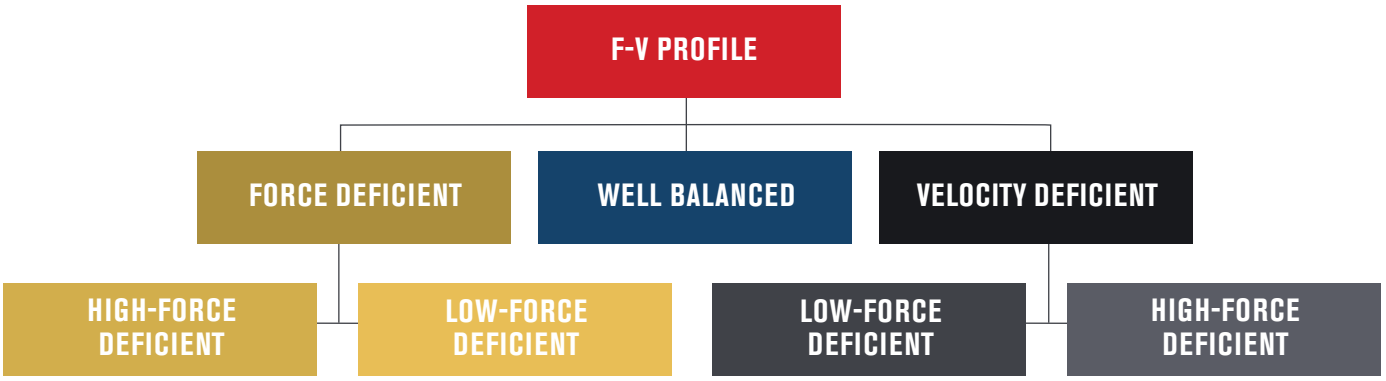
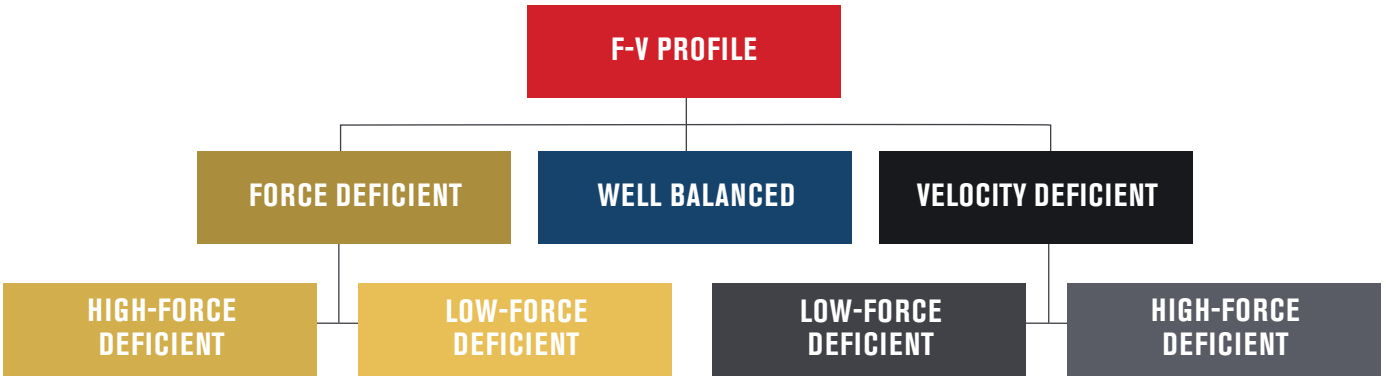


TABLE 32.1
STRENGTH AND POWER TRAINING PRESCRIPTIONS BASED ON DESIRED QUALITIES
%1RM – percentage of one repetition maximum

Adapted from Samozino et al. (2012)

QUALITY DESIRED	SETS	REPS	REST(S)	% 1RM	MEAN VELOCITY (M/S)	REPETITIONS IN RESERVE
STRENGTH	2-6	1-5	120-300	>80%	<0.5	0-2
STRENGTH-POWER	2-6	1-7	120-300	60-80%	0.5-0.75	1-3
POWER	2-6	1-7	120-300	40-70%	0.75-1.0	1-4
POWER-SPEED	2-5	2-6	60-180	30-60%	1.0-1.3	2-5
SPEED	2-5	2-6	60-180	0-40%	>1.3	3-5
HYPERTROPHY	1-8	6-20	30-120	60-80%	Slow Tempo	0-2
STRENGTH-ENDURANCE	1-3	12-25	30-60	50-70%	Moderate Tempo	1-3

FIGURE 32.1
FORCE-VELOCITY DECISION TREE



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STRENGTH-POWER	2-6	1-7	120-300	60-80%	0.5-0.75	1-3
POWER	2-6	1-7	120-300	40-70%	0.75-1.0	1-4
POWER-SPEED	2-5	2-6	60-180	30-60%	1.0-1.3	2-5
SPEED	2-5	2-6	60-180	0-40%	>1.3	3-5
HYPERTROPHY	1-8	6-20	30-120	60-80%	Slow Tempo	0-2
STRENGTH-ENDURANCE	1-3	12-25	30-60	50-70%	Moderate Tempo	1-3



Once the training prescriptions for the fighter have been decided on, appropriate planning within an overall strength and power training structure needs to be considered. Just like technical training, coaches are recommended to use a template that works for their conditions. This structure should also consider order of exercises, volume, loads and intensities and other acute training variables. An example of a strength and power training template is shown in Figure 32.2. This template highlights how exercises can be entered into the training plan appropriately based on a fighter's strength and power priorities (e.g., high-force deficiency).

The selection of exercises best suited to achieve the desired strength-power adaptations for fighters also needs to be considered based on MMA-specific performance and the limitations of the training environment and resources. One key aspect of MMA-specific performance that coaches should bear in mind is the force vector (e.g., horizontal, vertical) of any exercises selected. For example, horizontal vector pressing exercises (e.g., bench press) would generally be recommended to improve punching-related power over and above vertical vector pressing exercises (e.g., overhead press). Of course, exercise selection then needs to fit within the loading prescription parameters in Table 32.1, and some exercises may be better suited to different strength-power adaptations (e.g., a bench press may be better suited to training maximal strength than a standing cable horizontal press). As an example of how this would all merge into a strength-power program for MMA, a force-deficient fighter who wants to improve punching power would be better suited training a horizontal vector strength exercise with maximal strength loading parameters than a vertical vector strength exercise with hypertrophy loading parameters.

COACHES TALK

"Think of programming like a jigsaw puzzle. You now have a picture to work from. The next step is to put the end pieces together and finish the puzzle."

FIGURE 32.2

EXAMPLE OF UPPER BODY PROGRAM STRUCTURE BASED ON FIGHTER WITH HIGH-FORCE DEFICIENCY

PRIMARY MAX FORCE (PUSH)	**BB INCLINE BENCH PRESS** (Wave Loading > 85% 1PM) **BB BENCH PRESS + CHAINS** (Chains = 10-20% Total Load)
ACCESSORY STRENGTH-SPEED (PUSH)	**LANDMINE SINGLE ARM PRESS** (> 75% 1PM) **OR** **BB PUSH PRESS** (Mean Velocity 0.5 - 0.75 m/s)
ACCESSORY STRENGTH-SPEED (PULL)	**LANDMINE SINGLE ARM PRESS** (> 75% 1PM) **OR** **BB PUSH PRESS** (Mean Velocity 0.5 - 0.75 m/s)
ACCESSORY STRENGTH-SPEED (PULL)	**DB PRONE PISTON ROW OR** **BB PRONE SPEED PULLS** (Cluster / HVPT)
OTHER ACCESSORY	**NECK: PROTRACTION-RETRACTION** **TRUNK: ANTI-EXTENSION** (eg Ab Wheel Roll Outs) **WRIST / GRIP: BB WRIST ROLL UP**

EXAMPLE OF UPPER BODY PROGRAM STRUCTURE BASED ON FIGHTER WITH HIGH-VELOCITY DEFICIENCY

PRIMARY SPEED (PUSH)	**BAND ASSISTED PLYOMETRIC PUSH UP**
SECONDARY SPEED (PULL)	**PARTNER DEADBALL THROW-CATCH-SLAM**
ACCESSORY SPEED-POWER (PUSH)	**LANDMINE SINGLE ARM THROW OR** **SMITH MACHINE BENCH THROW** (C>2.0 m/s Peak Velocity)
ACCESSORY SPEED-POWER (PULL)	**DB PRONE PISTON ROW OR** **BB PRONE SPEED PULLS** (Cluster / HVPT)
OTHER ACCESSORY	**NECK: ROTATION (OR) BAND RESISTED LATERAL ISOMETRIC** **TRUNK: LOADED SWISSBALL RUSSIAN TWIST** **WRIST / GRIP: DB PRONTATE TO SUPINATE ROTATIONS**





PART 2
SECTION 33

SECTION 33: GENERAL PREPARATION: ENERGY SYSTEM DEVELOPMENT

By Kyle Larimer

The intermittent and unpredictable nature of MMA calls for fighters to adequately develop both anaerobic and aerobic energy systems if they wish to perform well in all competitive scenarios. For instance, the anaerobic alactic system supports the flurries of high-intensity efforts which lead to knockouts. Meanwhile, the anaerobic lactic or glycolytic system helps fighters sustain high work rates in rounds and cope with the high levels of lactate reported in numerous combat sport and MMA competitions. Further, the aerobic system helps fighters maintain their work rate as competition extends into later rounds, helps buffer against the fatigue caused by metabolic waste products and enhances the replenishment of the anaerobic alactic system. In terms of distribution between the energy systems, the aerobic system will contribute as much as 50 percent of overall energy production as early as one minute into high-intensity exercise. All things considered, the development of both anaerobic and aerobic metabolic power is essential for MMA athletes.

This need for development of both anaerobic and aerobic metabolic power is also apparent when reviewing the physical requirements of individual combat sports that make up MMA. Table 33.1 shows blood lactate levels and work-to-rest ratios recorded for five different combat sports. It is notable that wrestling, which is one of the most physically demanding aspects of MMA, produces the highest lactate levels of the other combat sports. It is also apparent that depending on the techniques used in a fight and considering the scenarios that are unique to MMA (e.g., fence work, ground strikes, transitions), the energy system demands may vary considerably. As a fighter cannot always be sure of the combat style they will be engaged in during competition (e.g., a fighter may be especially prepared for striking exchanges but be forced to grapple and vice versa), it is crucial fighters prepare for these varied energy system demands.

PRACTICAL APPLICATION AND IMPLEMENTATION

The general preparation period gives fighters an opportunity to develop energy system qualities that can handle a wide range of physical outputs and allows for focused development of energy system weaknesses. The general preparation is an optimal time for a fighter to focus on energy system development as the technical training volume and intensity are usually lower, and any interference of energy system training on technical training is not as important compared to other phases in a fight cycle (e.g., fight-camp). Consideration should also be given to how technical training can contribute to the fighter's energy system development, and non-technical training should target energy systems needs that are not being addressed in technical train-

TABLE 33.1
BLOOD LACTATE AND WORK-TO-REST RATIOS OF DIFFERENT COMBAT SPORTS

	SPORT	BLOOD LACTATE (MMOL/L)	WORK : REST
GRAPPLING	Brazilian Jiu-Jitsu	10.1	6:1, 8:1, 10:1
	Wrestling	14.8-20	2:1, 3:1
	Judo	12.3	2:1, 6:1
STRIKING	Muay-Thai	9.72	5:1
	Boxing	12-13.5	4:1

TABLE 33.2
EXAMPLE CONSIDERATIONS AROUND DEVELOPING INDIVIDUALIZED ENERGY SYSTEM TRAINING PLANS FOR FIGHTERS

	ATHLETE A	ATHLETE B
ASSESSMENT RESULTS	Poor VO2peak Low first ventilatory threshold percentage of VO2peak (VT1) Poor anaerobic capacity High alactic and anaerobic power	Good VO2max High second ventilatory threshold percentage of VO2max (VT2) Poor alactic power
FIGHT PERFORMANCE REVIEW	Several first-round finishes Output decreases in each successive round Drained by grappling	High output throughout fight "Slow starter"
FIGHTING STYLE	Power striker	High-volume striker Chain wrestler
GENERAL PREPARATION ENERGY SYSTEM GOALS	Increase aerobic capacity and raise VT1	Increase exposure to repeated high-intensity alactic efforts (local muscular adaptions)

TABLE 33.3
EXAMPLE PROTOCOLS TO DEVELOP THE CAPACITY OF THE DIFFERENT ENERGY SYSTEMS

ENERGY SYSTEM	WORK : REST	SETS
ALACTIC	4-8 seonds work (sprint), 45-6 seconds rest	10-20
LACTIC	15-60 seconds work, 1-4 minute rest	6-10
AEROBIC	3-5 minute work, 1-5 minute rest	3-5

ing (e.g., if technical drilling during general preparation is targeting an aerobic base through prolonged efforts, then non-technical training may target the development of anaerobic alactic capacity).

After considering what energy system work is being completed in technical training, the next step in developing the training plan starts by assessing the energy systems of the fighter. These assessments and normative values for the UFC roster are detailed in Section 10. Any energy system training plan should be most heavily influenced by the athlete's individual needs. While rules of thumb about the general and specific preparation periods and their program details can be made, the plan that best supports the individual should be used. Table 33.2 presents two different athletes, their energy system assessment results, fight performance evaluations, fighting style and what kind of training they would benefit from during a general preparation period.

Once diagnostics from these assessments have been made, the training plan needs to be contextualized within the overall training structure. In general preparation, energy system development should largely focus on augmenting the capacity of each energy system that needs improvement (e.g., anaerobic alactic, anaerobic lactic, aerobic). Examples of how to train the capacity of these three energy systems are presented in Table 33.3.

During general preparation, coaches also have more opportunity to emphasise a single energy system capacity in each training cycle which may help with faster adaptations for the fighter. Any modality or work-to-rest ratio combination that is safe for the fighter and effective in achieving the set performance goals can be used during this time. The biomechanical load of the modality used for conditioning should be considered (e.g., "off-feet" vs "on-feet" conditioning) especially as the fighter is likely returning to training after a period of little conditioning. The modality selection is also influenced by weight class and injury history. For example, an athlete with a previous knee injury may benefit from modalities that have low biomechanical load to reduce any chance of re-injury. Heavier fighters may also want to do the same considering the extra load from their increased body mass.



PART 2

SECTION 34

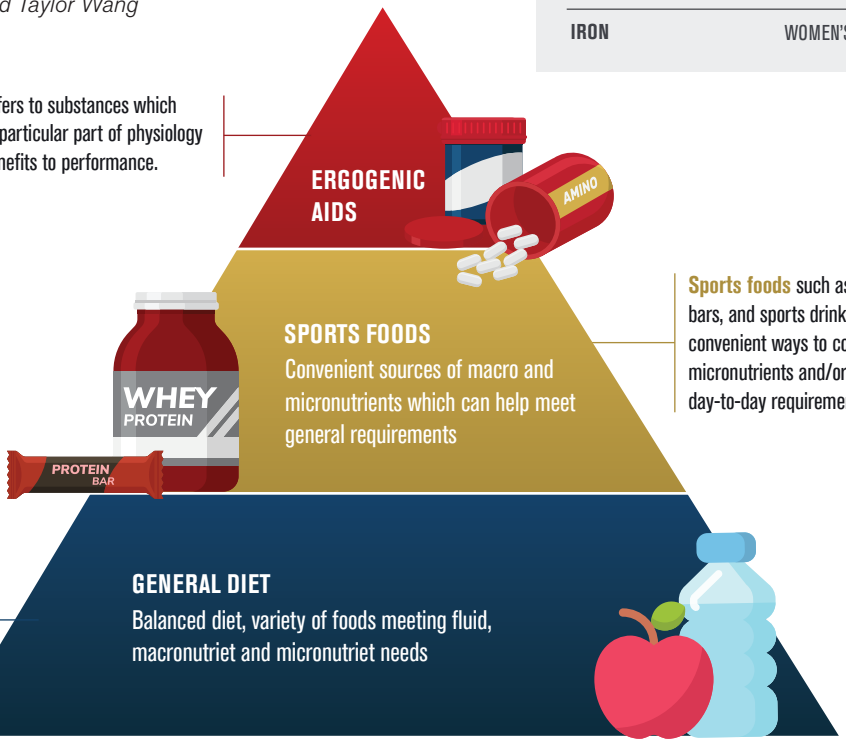
GENERAL HEALTH AND WELL BEING

By Alexa Eisenberg and Taylor Wang

SUPPLEMENTS FOR GENERAL HEALTH

MULTI-VITAMINS	PREVENT VITAMIN DEFICIENCY
OMEGA 3	BRAIN, JOINT, ANTI-INFLAMMATION
CURCUMIN, GLUTATHIONE	ANTI-INFLAMMATION
IRON	WOMEN'S HEALTH

Ergogenic aids refers to substances which can interact with a particular part of physiology that can provide benefits to performance.



Sports foods such as protein powder, energy bars, and sports drinks are products that are convenient ways to consume macro and micronutrients and/or fluid to help meet basic day-to-day requirements.

A balanced **general diet** that meets your nutrients and hydration needs is the basis of the performance pyramid.

SPORTS NUTRITION PYRAMID
A tiered-system approach

ATHLETE'S PLATE
Fueling for performance

Plan your carbohydrate intake in response to your training intensity.

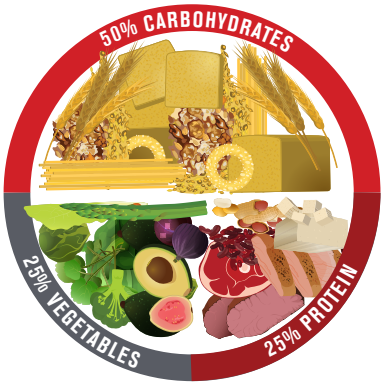
Ensure adequate and high-quality protein intake as the starting point for your plate.

1.5-2G PROTEIN PER KG BODY WEIGHT



Easy Session

¼ of the plate should be carbohydrate If you have an **easy session** or trying to lose weight



Hard Session

½ of the plate should be carbohydrate if you have a **hard session** or trying to put on weight





PART 2

SECTION 35

SECTION 35: WEIGHT-DESCENT PREPARATION

by Clint Wattenberg

During off-camp, fighters may have different fueling, training, recovery and body composition or weight management priorities. These priorities depend upon many factors, including:

Weight Division Fit (see Section 12)
- Fat-Free Mass/Weight Division (FFM/WtDiv)
- Weight-Making Preparedness Score (WMPS)
- Weight-Making Risk Score (WMRS)

Metabolic Status
- Resting Metabolic Rate (RMR) compared to predicted

Gender
- Menstrual regularity, hormonal contraception

Weight-Making History
- Incidents of missing weight or difficult weight cuts

Technical and Non-Technical Training Status and Needs
Injury Status

WEIGHT-MAKING PREPAREDNESS SCORE

Of special consideration in the off-camp phase is the WMPS. The WMPS takes into account a fighter's body mass compared to his or her target weight pre-fight week, FFM, fat mass (FM), and RMR. Each of these factors are critical components of the athlete's ability to complete a weight descent during fight-camp and make weight effectively and efficiently. The WMPS can also direct off-camp tactics around weight, body composition and/or metabolic interventions. This score is most relevant when a fighter's body mass and fat mass are higher and requires more pre-fight camp preparation. Further detail on how the WMPS is calculated is detailed in Figure 35.1, and as an example, a male lightweight athlete with a total mass of 179 pounds and body-fat percentage of 15 percent (152 pounds FFM and 27 pounds FM), along with a RMR percentage of predicted of 110 percent would have a WMPS of 56. The average WMPS in pounds across the complete men's and woment's weight divisions are provided in Figure 35.2.

Required Equipment: Dual x-ray absorptiometry (DXA), bioelectrical impedance analyzer (BIA) or other body composition assessment and metabolic cart.

FIGURE 35.1
WEIGHT-MAKING PREPAREDNESS SCORE (WMPS) BREAKDOWN

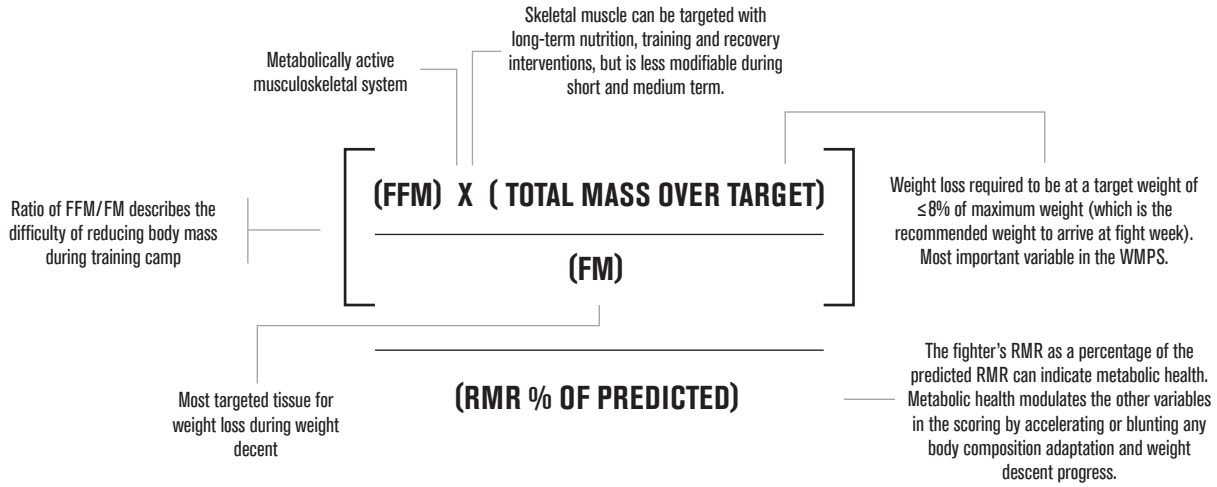
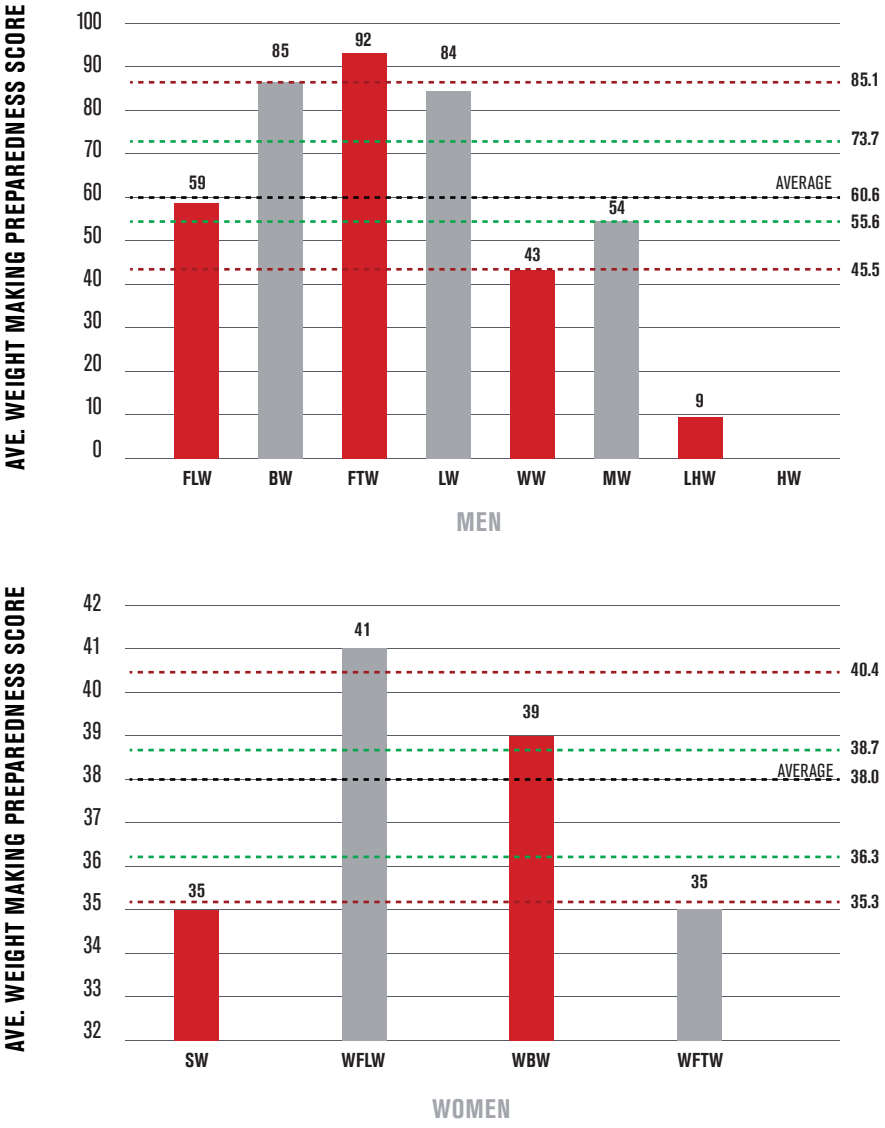


FIGURE 35.2

UFC WEIGHT-MAKING PREPAREDNESS SCORE BREAKDOWN FOR MEN AND WOMEN



In Figure 35.2, WMPS are compared as percentiles across men's and women's weight divisions. This data indicates that men's bantamweight, featherweight and lightweight and women's flyweight athletes are the most unprepared to make weight in a realistic fight-camp timeframe, making for more difficult weight cuts. Individual fighters should aim to be in the middle of the range in order to balance both performance and health considerations.

Once a fighter knows his or her WMPS, this can be combined with their FFM/Wt-Div score to help formulate the appropriate nutrition and training strategies during off-camp. These strategies and tactics are detailed in Table 35.1.

TABLE 35.1

APPROPRIATE WEIGHT-DESCENT PREPARATION STRATEGIES FOR FIGHTERS BASED ON HIS OR HER FAT-FREE MASS COMPARED TO THE WEIGHT DIVISION AND WEIGHT-MAKING PREPAREDNESS SCORE

	LOW	HIGH
FFM/WTDIV	**STRENGTH AND POWER DEVELOPMENT** (SEE SECTIONS 32 AND 51)	**HYPERTROPHY MITIGATION** (SEE SECTIONS 34 AND 67)
WMPS	**PERFORMANCE NUTRITION FOR WEIGHT GAIN OR MAINTENANCE** (SEE SECTION 67)	**BODY COMPOSITION OPTIMIZATION AND METABOLIC / HORMONE SUPPORT** (SEE SECTION 67)





PART 2
SECTION 36

SECTION 36: THE FEMALE ATHLETE: TRAINING AND FUELING CONSIDERATIONS

By Nicole Alai

Females experience monthly fluctuations in sex hormone concentrations that represent three distinct phases of the menstrual cycle: follicular, ovulatory and luteal. Within each of the phases, levels of specific sex hormones (i.e., estrogen, follicle stimulating hormone (FSH), luteinizing hormone (LH) and progesterone) are altered. As a result, women experience physiological changes throughout the 25-day to 36-day menstrual cycle that are represented by a variety of symptoms. Each of these symptoms can have a significant effect on components of athletic performance, including the cardiorespiratory system, fluid regulation, inflammation/recovery, cognitive function, injury/illness, gut health, sleep and metabolism. Consequently, specific consideration should be given to female athletes when seeking to optimize health, wellbeing and athletic performance.

THE MENSTRUAL CYCLE

The menstrual cycle is, on average, 28-days long and can be broken down into three phases (see Figure 36.1):

Follicular (Day 1-13): This phase is the start of menses. FSH concentrations increase during the last few days of the menses. This is associated with a rise in estrogen and progesterone levels, in parallel with the growing ovarian follicle. Both estrogen and progesterone act as a negative feedback, subsequently causing FSH concentrations to decline.

Ovulation (Day 14): Begins with a large rise in LH and FSH. LH stimulates egg release over 24-hours while also causing a swift and sudden decline in estrogen levels and the rise of progesterone.

Luteal (Day 15–28): LH and FSH levels decrease. The egg is released forming the corpus luteum, which produces high amounts of progesterone. Estrogen is still in relatively high concentrations during this phase. However, if there is no fertilization, there is a marked decrease in both progesterone and estrogen levels, which leads to the start of a new cycle and menstrual bleeding begins again.

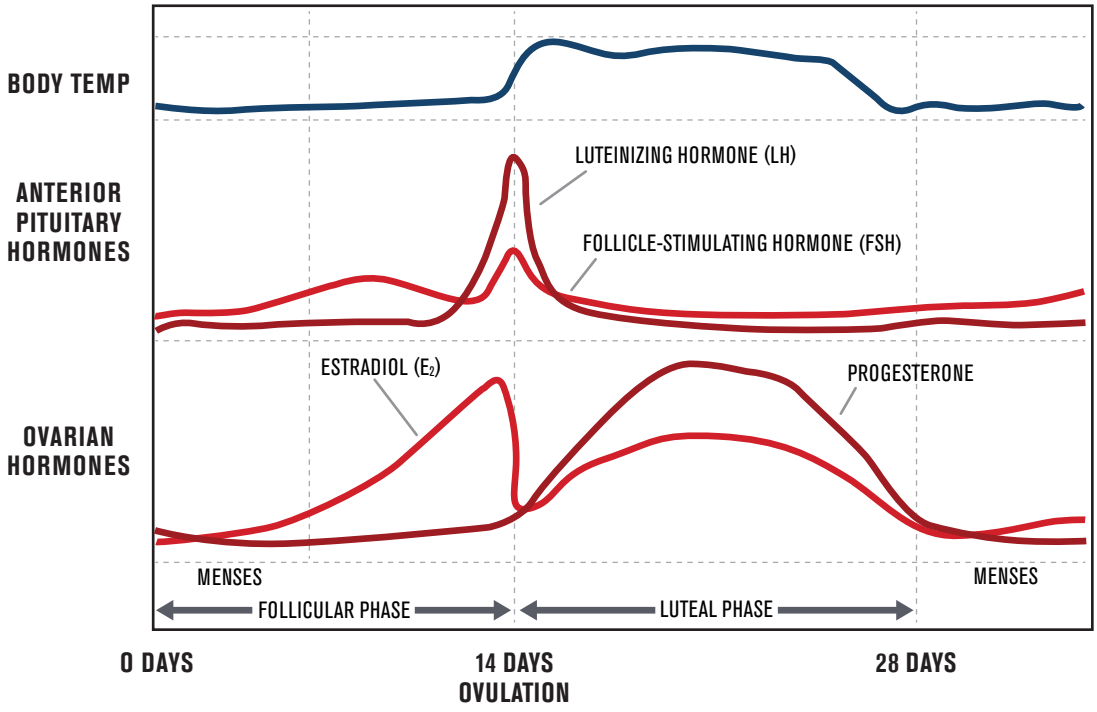
MENSTRUAL CYCLE AND METABOLISM

High levels of circulating estrogen during the follicular phase promotes the breakdown of fat, which increases fatty acid availability and spares liver and muscle glycogen. Progesterone on the other hand, is known to have anti-estrogenic effects. The high levels of progesterone commonly seen in the luteal phase increase glycogen utilization and antagonistically reduces fatty acid availability. Therefore, there is a shift from fat to carbohydrate as a fuel during this phase, which has obvious implications for female athletes during competition preparation and weight-making based on when their menstrual cycle falls. Given that the follicular phase blunts carbohydrate and spares glycogen, female athletes may need to consider supplementing their diet with sources of carbohydrates to meet the increased needs of

COMMON MENSTRUAL CYCLE SYMPTOMS

- Mood changes
- Uterine cramps
- Aches/pains
- High body temperature
- Breathing changes
- Nausea
- Fatigue
- Bloating
- Insomnia
- Cravings
- Bowel irregularities

FIGURE 36.1
THE MENSTRUAL CYCLE



high-intensity training. When female athletes move into the luteal phase, there is a decrease in fat and an increased availability of carbohydrates for fuel. Taking advantage of the body's ability to utilize carbohydrate more readily would be advantageous during high-intensity sessions, minimizing the need for additional dietary sources.

MENSTRUAL CYCLE, INFLAMMATION AND RECOVERY

Estrogen has antioxidant properties and can decrease inflammation. Indeed, it has been found that some inflammatory markers (e.g., creatine kinase, interleukin-6) are in greater concentration 24-72 hours after high-intensity training during the mid-follicular phase (lower estrogen levels), compared to the luteal phase (higher estrogen levels). The higher concentration of estrogen found in the mid-luteal phase seems to attenuate inflammation and can therefore mitigate the delayed onset of muscle soreness after exercise. Contrary to this, it is likely that female athletes may experience increased post-exercise soreness during the mid-follicular phase of their cycle. It would therefore be recommended that greater recovery following intensive exercise is considered for females training in the mid-follicular phase, compared to the mid-luteal phase. Female athletes should also consider increasing anti-inflammatory foods to optimize recovery during this phase.

MENSTRUAL CYCLE AND GUT HEALTH

Decreased gut permeability (i.e., how easily substances pass through the intestinal wall) is associated with premenstrual characteristics, including fatigue, anxiety symptoms and food cravings. If gut permeability and leaky gut-type symptoms are an issue, female athletes should consult a sports dietitian. However, nutrition recommendations typically include optimizing fiber intake by consuming a total of 25-35 grams of insoluble and soluble fiber a day. In addition, female athletes should eat foods that are both prebiotic (e.g., onions, leeks, asparagus and bananas) and probiotic-rich (e.g., kefir, yogurt, sauerkraut and kimchi).

MENSTRUAL CYCLE AND INJURIES

Women have been reported to be three to six times more likely to suffer ACL injuries compared to men. This may be due in part to female hormone concentrations, which have been reported effect ligaments and tendons. Higher ACL laxity has been seen in the ovulatory phase of the menstrual cycle, where estrogen is at its highest concentration, compared to luteal and late-follicular phase. Furthermore, as estrogen increases, joint and muscle laxity can also affect postural stability. As such, during the late-follicular through the mid-luteal phase, female athletes may consider eating foods that have greater amounts of glucosamine, chondroitin and collagen in order to optimize ligament and tendon recovery (e.g., shellfish, fish, chicken and eggs) or supplementing with these nutrients directly.

MENSTRUAL CYCLE AND COGNITIVE FUNCTION

Pre-menstrual syndrome (PMS) can be presented in both physical and mental symptoms. Both estrogen and progesterone are neuromodulators that influence the central nervous system, as well as effecting mood and behavior. For example, women in the mid-luteal phase (moderate estrogen and high progesterone) have exhibited increases in salivary cortisol levels from social stress compared to women in the follicular phase or those taking an oral contraceptive (OC). Furthermore, the sudden decline in estrogen and progesterone common in the pre-menstruation period (i.e., late luteal phase, day 24-28) is associated with higher rates of depression and anxiety. Due to the effects of fish oil on mental health, female athletes should consider their DHA and EPA intake during the luteal phase and supplementing 2.5g of omega-3 fatty acids/day may be recommended. This has been shown to reduce salivary cortisol levels, improve mood and concentration, and reduce anxiety in females during the luteal phase.

MENSTRUAL CYCLE AND CARDIO-RESPIRATION

At the beginning of the menstrual cycle (i.e., the follicular phase), respiratory rate is slower, but as the cycle moves into the luteal phase, there is a marked increase in breathing and heart rate. This is related to the higher progesterone and lower estrogen levels. Both of these hormones affect body fluid and sodium regulation by minimizing thirst and down-regulating antidiuretic hormones during exercise. This can cause water retention and swelling, particularly in the luteal phase.

Core temperature in the luteal phase is higher than the follicular phase (37.8 to 37.9 degrees Celsius vs 37.2 to 37.3 degrees Celsius). Therefore, female athletes in the luteal phase may experience mild hyperthermia and excessive sweat loss during exercise. As such, during the luteal phase, female athletes should prioritize thermoregulation and hydration. This can be done by consuming cold water (16 to 24 ounces) with electrolytes (~500 mg of sodium) during training to minimize increases in body heat and sweat loss. Utilizing a heart rate monitor may also be recommended to ensure female athletes are staying in more moderate heart rate ranges during the luteal phase to limit the load on the cardio-respiratory system.

During the luteal phase, when progesterone concentrations are high, there is a marked increase in breathing rate and resting heart rate. This can affect sleep quality, especially as the body moves from follicular to ovulatory to luteal phase. Furthermore, some female athletes may experience respiratory symptoms like asthma and shortness of breath, which may be caused by the elevated progesterone in the luteal phase.

ORAL CONTRACEPTIVES

Many female athletes report strategically using OCs for the purpose of minimizing or alleviating the side-effects associated with the menstrual cycle, such as cramps, pain, bloating and headaches. However, OC's suppress pituitary production of FSH and LH and prevent ovulation. This may reduce the body's ability to sweat efficiently, causing increases in core body temperature and heart rate and may be detrimental to athletic performance. Indeed, there is some limited evidence that indicates OC use may be related to inferior exercise performance when compared to naturally menstruating women, but this area largely remains under researched.

MENSTRUAL CYCLE TRACKING

In order to better understand the effects of hormonal fluctuations within the menstrual cycle, female athletes are encouraged to track premenstrual symptoms. This information can be valuable for periodizing nutrition and training. For example, cutting weight can be harder due to fluid retention in the luteal phase. Tracking the menstrual cycle means female athletes can be more aware of when their fight-week weight cut will occur in their menstrual cycle and create a plan to begin an earlier weight descent if needed. Using menstrual cycle tracking applications on smart devices can allow the athlete to update and access this information at any time.

Table 36.1 provides a summary of the fundamental considerations relating to female athlete physiology and performance optimization.

TABLE 36.1

OVERVIEW OF MENSTRUAL CYCLE SYMPTOMS AND ASSOCIATED INTERVENTIONS

PHYSIOLOGICAL PROCESS	PHASE-ASSOCIATED CHANGES / SYSTEMS AFFECTED	AREA OF FOCUS
METABOLISM	Follicular: Lipolysis, decrease gluconeogenesis, spares muscle/liver glycogen Luteal: Decreased hepatic glycogenolysis, utilize glycogen	Follicular: Fatty acid utilization Luteal: Blood glucose utilization
INFLAMMATION	Early & Mid- Follicular (Days 1-10): Greater duration (~72 hours) of CK and IL-6 found in the blood Mid-Luteal (Days 18-25): Shortened duration of CK and IL-6 found in the blood	Early & Mid-Follicular: Requires more recovery Mid-Luteal (Days 18-25): Requires less recovery
GUT HEALTH	Follicular: Less gram-negative commensal bacteria load and decreased gut permeability. Luteal: Higher gram-negative commensal bacteria load and increased gut permeability	Follicular: Continue to consume normal diet Luteal: Include additional pre- and probiotics into diet and consider supplementation.
INJURY	Follicular: Increase ligament and tendon laxity. Luteal: decreased ligament and tendon laxity.	Follicular: increase consumption of foods rich in collagen. Also consider supplementing with glucosamine (500mg) and chondroitin (250mg). Luteal: Continue to consume normal diet.
SLEEP	Follicular: Good sleep Luteal: Poor sleep	Follicular: Continue normal sleep routine Luteal: Use sleep hygiene tactics and consider supplementing with 3g melatonin or 200mg of magnesium bisglycinate
COGNITIVE FUNCTION	Follicular: No abnormal emotional or behavior changes Luteal: Increased anxiety, depression and mood disorders	Follicular: Continue normal routine Luteal: Take 2.5g of omega 3 fatty acids.
CARDIO-RESPIRATORY	Follicular: No abnormal respiratory rate or heart rate, body temperature or sweat rate. Luteal: increased respiratory rate, heart rate, body temperature and sweat rate	Follicular: Continue normal hydration routine Luteal: Consider ice cold water with additional electrolytes during training
ORAL CONTRACEPTIVE PILLS AND ATHLETIC PERFORMANCE	Follicular: FSH and LH levels similar Luteal: Decreased FSH and LH levels	Follicular: Athletic performance similar Luteal: Athletic performance may be decreased
SYMPTOM TRACKING	Neurological, musculoskeletal, cardiorespiratory, gastrointestinal, nutrition, sleep, physical activity, and reproductive phase	Anxiety, depression, focus, stress, fatigue, back ache, uterine cramps, core body temperature, heart rate, edema, breathing rate, nausea, vomiting, diarrhea, constipation, bloating, food intake, cravings, hunger level, total sleep time, sleep latency, exercise duration and intensity, and current phase (follicular, ovulation or luteal)



PART 2
SECTION 37

SECTION 37: SUPPLEMENTS AND ANTI-DOPING

By Reid Reale and Charles Stull

UFC is committed to a performance-enhancing, drug-free sport and protecting the integrity of MMA at every level. The United States Anti-Doping Agency (USADA) is recognized by UFC as its official, independent anti-doping agency. USADA, which comes under the umbrella of the World Anti-Doping Agency (WADA), works with its network of international doping control officers and other independent anti-doping organizations around the world to ensure that all UFC athletes are subject to the anti-doping program run by USADA, no matter where they live, train or compete.

Athletes are tested to ensure they do not utilize any substance or methods which are included on the USADA Prohibited List: https://ufc.usada.org/wp-content/uploads/UFC-Prohibited-List.pdf
A substance or method is included on the USADA prohibited list if it meets at least two of the following three criteria: i) it enhances, or has the potential to enhance, sport performance; ii) it represents an actual or potential health risk to the athlete and iii) it violates the spirit of sport. Example substances and methods found within the Prohibited List include anabolic steroids, stimulants, diuretics and masking agents and the use of intravenous (IV) rehydration.

Aside from knowingly using banned methods or substances, athletes also expose themselves to the potential risk of a violation whenever taking over-the-counter dietary supplements. Many dietary supplements can contain ingredients, including ones not listed on the label, that are prohibited. Indeed, the only way to be 100 percent certain that supplements are safe to use is to not use supplements at all. However, it is understood that owning to the rigors of training and competition, athletes seek the use of dietary supplements to support their performance, recovery, sleep, health and well-being—and a variety of other factors.

USADA has always recommended that athletes use only dietary supplements that have been certified by a third-party program that tests for substances identified as prohibited in sport. If athletes choose to use supplements despite the potential risks of tainted products that may lead to a doping violation, it is very important to only use Certified Supplements, which bare the stamps of approval listed below in Figure 37.1. Athletes will not receive an anti-doping policy violation if they can establish clear and convincing evidence their positive test was due to contamination of a supplement certified by one the following third-party testing schemes.

For more information see: https://ufc.usada.org/

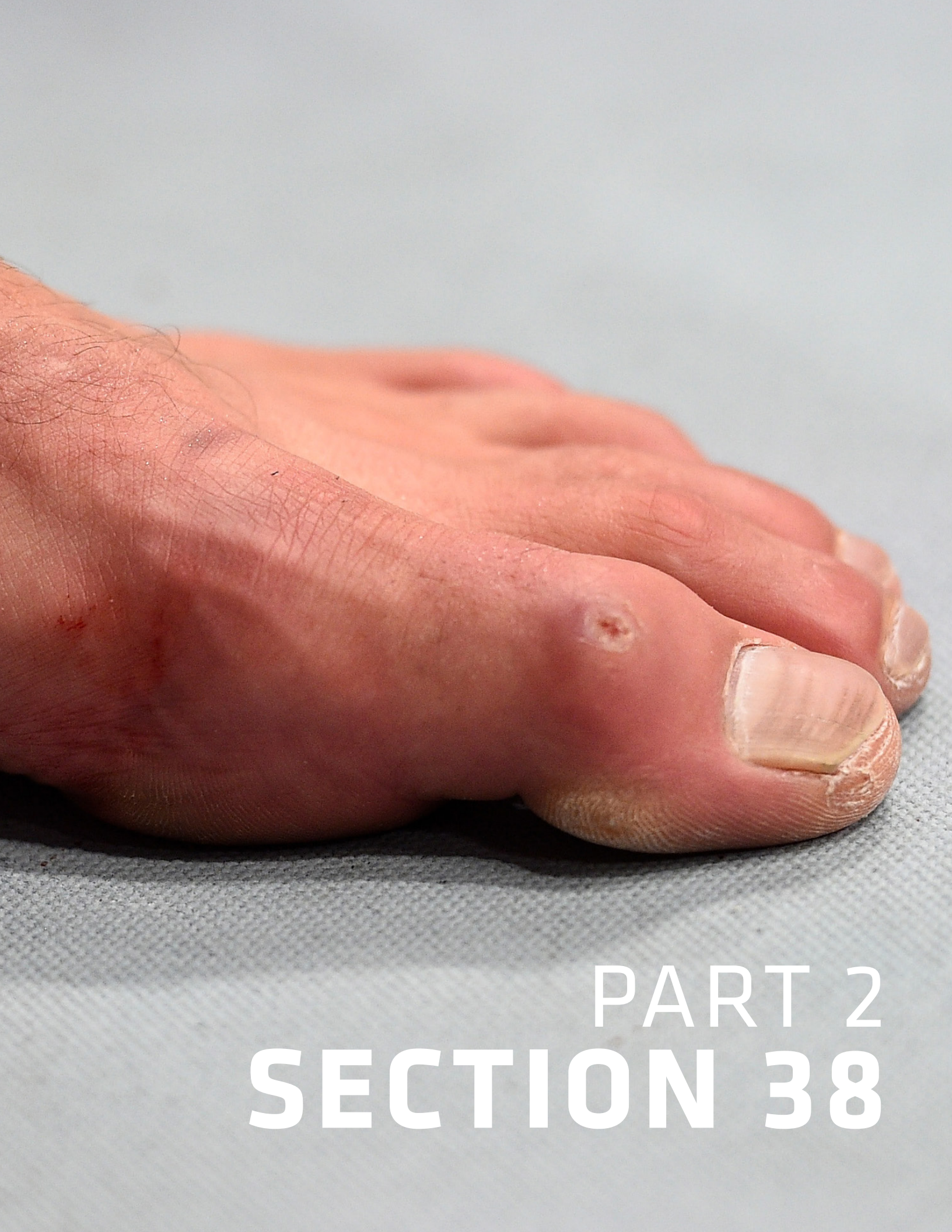
FIGURE 37.1
APPROVED CERTIFICATIONS FOR SUPPLEMENT SAFETY

The below supplements are the ONLY supplements approved under UFC ADP. These should be the only supplements you use.



You will be protected should any issues result from using these supplements.
If you use supplements other than those above, you are NOT protected.





PART 2

SECTION 38

SECTION 38: THE BAREFOOT ATHLETE: TRENDS AND CHARACTERISTICS

By Paul Holmes

In MMA, fighters are exposed to long periods of training barefoot as almost all training is done without shoes. Training barefoot is considered to be superior to training in shoes for strengthening the muscles in the foot and ankle. It may also be associated with a reduced rate of lower limb injury in other sports (e.g., running). Conversely, there is a relationship between barefoot training in combat sports (e.g., muay thai, taekwondo and karate) and increased risk of lower limb contact injuries due to a lack of protection. Furthermore, there may be a connection between increased training volume and time on-feet without shoes and repetitive stress or overuse injuries in the lower limb. Although there is mixed evidence currently available, a related factor that may influence lower limb overuse injuries is foot morphology. Foot morphology is the structure and function of the foot (e.g., navicular drop, which is a measure of foot pronation) and is important to consider as it influences the ground reaction forces and angles of force absorbed through the lower limb during activity.

Along with navicular drop, ankle dorsiflexion (i.e., the angle created at the ankle when pulling the toes and foot up toward you) is another measure to consider with its association to lower-limb injury risk. Currently, there remains limited data on these relationships across weight divisions in UFC. The ranges of dorsiflexion and navicular drop across all weight divisions in UFC are detailed in Figures 38.1 and 38.2. The average dorsiflexion range of motion of fighters across weight divisions is generally considered to be good compared to other athletic populations, with ranges typically above 40 degrees of motion. The exception to this are male heavyweights whose average dorsiflexion was just below the accepted range of motion in athletic populations. Navicular drop is another area where male heavyweights demonstrate suboptimal ranges, and this may be related to their increased body mass. As a result, it is recommended that heavyweight fighters include regular ankle mobilisation and foot intrinsic muscle strengthening exercises as part of their warm-ups and remedial training sessions to mitigate potential injury risks. Additionally, selecting appropriate footwear for non-technical training or non-training activities may be beneficial for not just heavyweights, but for athletes across all divisions.

When selecting appropriate footwear, it is important to consider foot type, activity and comfort. Common types of shoes (based on foot motion: e.g., pronation, neutral and supination) and shoe features are presented in Table 38.1. In terms of shoe selection for activity, cross-training shoes are designed to meet the demands of multiple tasks, including gym and running-based work. However, if spending more time on specific training activities, selecting shoes designed for that particular activity is appropriate (e.g., trail shoes are more appropriate for off-road and trail running than regular running shoes.) For strength and power training, minimalist or more rigid shoes may be appropriate depending on individual preference.

TABLE 38.1
COMMON FOOT MOTION TYPES ALONG WITH SHOE FEATURES AND FUNCTIONS FOR EACH FOOT MOTION TYPE

FOOT TYPE	SHOE TYPE	SHOE FEATURES	FUNCTION
Pronator	Motion control	Firm counter with rearfoot stabilizer and snug fit around midfoot. Robust (leather) upper	Control foot position to reduce excessive pronation
Neutral	Stability	Cushioning with medial arch support	Support foot without restricting movement
Supinator	Cushioned	Cushioned midsole, high-quality sock liner	Absorb shock of ground-reaction forces

The effectiveness of training shoes deteriorates over time depending on the amount of use and the weight of the individual wearing them (i.e., heavier weight division fighters should change their shoes more often than lighter weight division fighters). An appropriate amount of time to change training shoes is every six to 12 months.

FIGURE 38.1

THE AVERAGE DORSIFLEXION RANGE OF MOTION FOR UFC FIGHTERS IN EACH WEIGHT DIVISION

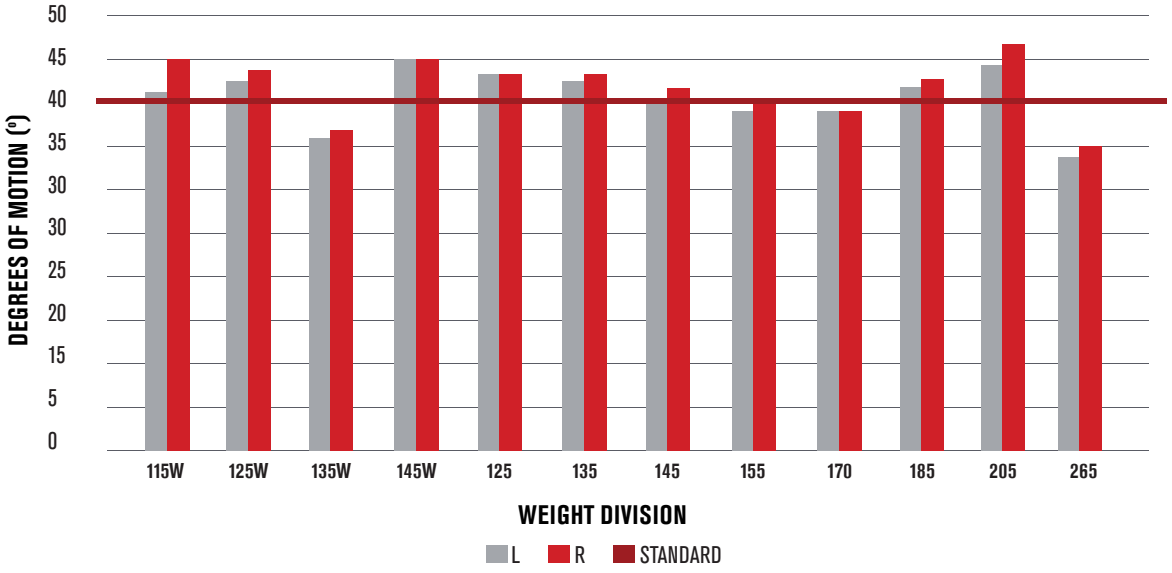
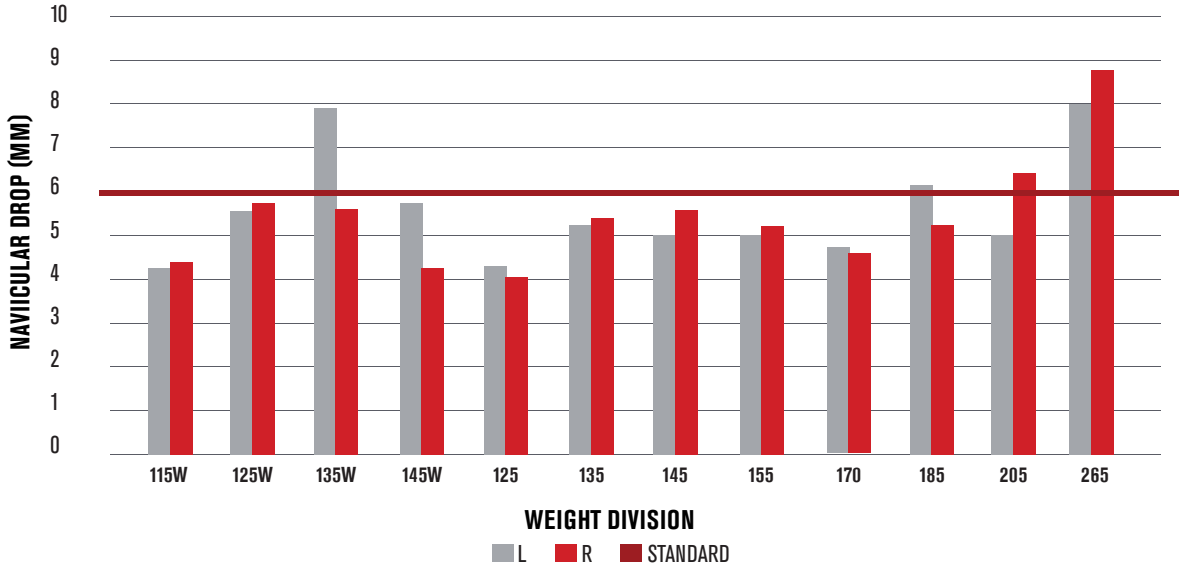


FIGURE 38.2

THE AVERAGE NAVICULAR DROP FOR UFC FIGHTERS IN EACH WEIGHT DIVISION

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PART 2
SECTION 39

SECTION 39: MANAGING TRAINING LOAD AND REDUCING RISK OF INJURY AND ILLNESS

By Alice Ai, Felix Falkenberg and Joseph Coyne

Injuries are an unfortunate part of MMA. There can be a number of negative effects of injuries on fighters, such as lost training time, impaired confidence or other mental issues, susceptibility to future injuries and even early retirement. As such, coaches and fighters should actively try to reduce the risk of unnecessary injuries occurring. One way of doing this is by managing the training load of a fighter. As mentioned in previous sections, training load that is well-managed can result in beneficial adaptations in joints, muscles and connective tissue along with beneficial adaptations in the immune system. Meanwhile, poorly managed training load may lead to detrimental adaptations in these tissues or systems and injury and illness. Injury and illness risk will not solely be dependent on training load, and other factors like lack of sleep, academic study, poor nutrition, low strength levels and an unsafe training environment will also moderate this risk and should be considered by coaches and fighters.

"Spikes" in training load, especially in undertrained athletes, seems to increase injury and illness risk. These training load "spikes" may be due to rapid increases in training intensity, training volume or both. Figure 40.1 illustrates an example of where a "spike" in training load has been related to injury in a fight preparation. It should also be considered that these "spikes" in training load can also be due to previous "troughs" where an athlete has an extended break from training (e.g., after a fight) and a gradual increase in training load upon return to training may be warranted. Figure 40.2 provides an example of how an inappropriate level of training load after an athlete has just returned to training may impact the fight preparation. Along with "spikes," chronically high levels of training load (i.e., when the fighter does not get an opportunity to rest and recover) may also contribute to injury risk. Figure 40.3 shows how uninterrupted high levels of training load may negatively affect a fight preparation. When interpreting any training load measures, athlete readiness (e.g., subjective wellness, heart rate variability, direct current potential) should also be used to help contextualize the levels of training load. In Figures 40.1, 40.2 and 40.3, subjective wellness data from the Short Recovery and Stress Scale has also been provided to help better understand the interaction between training load and athlete readiness.

FIGURE 39.1
A SPIKE IN TRAINING LOAD CAUSING INJURY IN A FIGHT PREPARATION

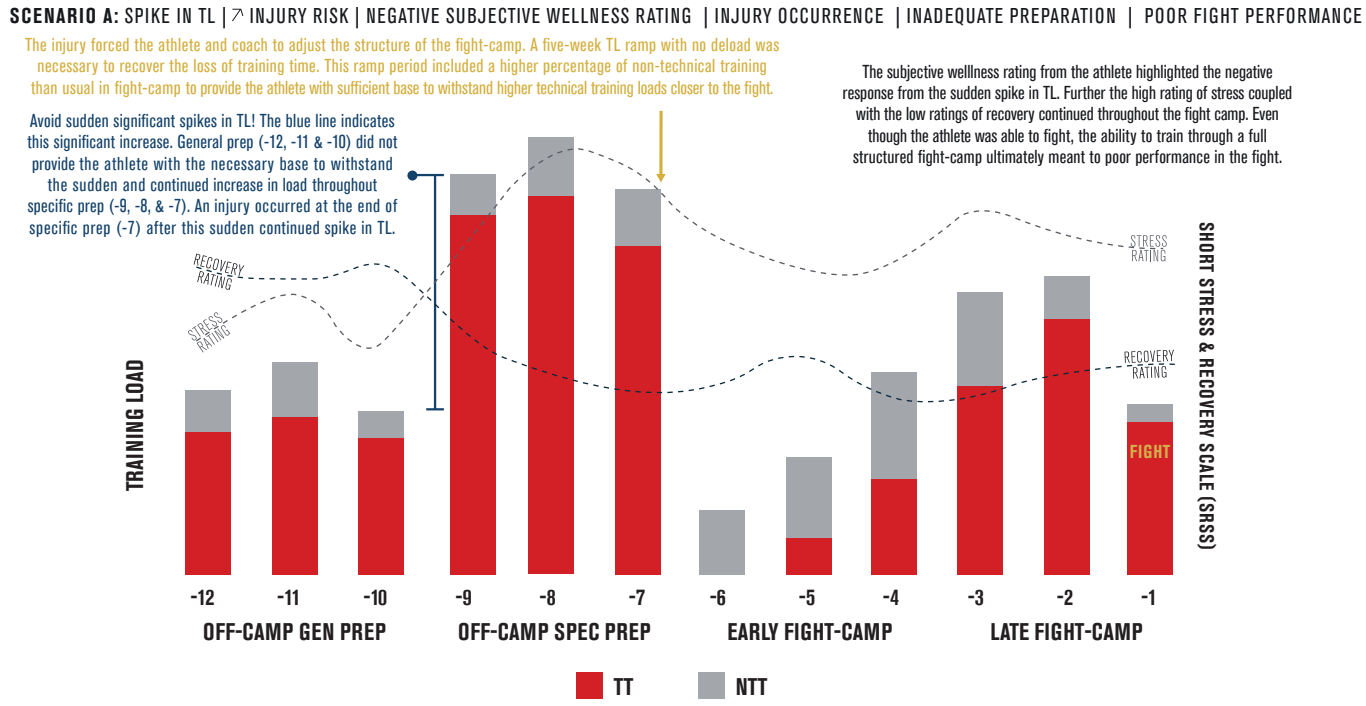


FIGURE 39.2

A "TROUGH" IN TRAINING LOAD (E.G., AFTER A FIGHT) CAUSING INJURY IN A FIGHT PREPARATION

SCENARIO B: 2 FIGHTS | SPIKE IN TL | INJURY IN PREPARATION FOR 2ND FIGHT | SUBJECTIVE WELLNESS SHOWED SIGNS | RETURN TO FULL TRAINING PHASE | ABLE TO FIGHT

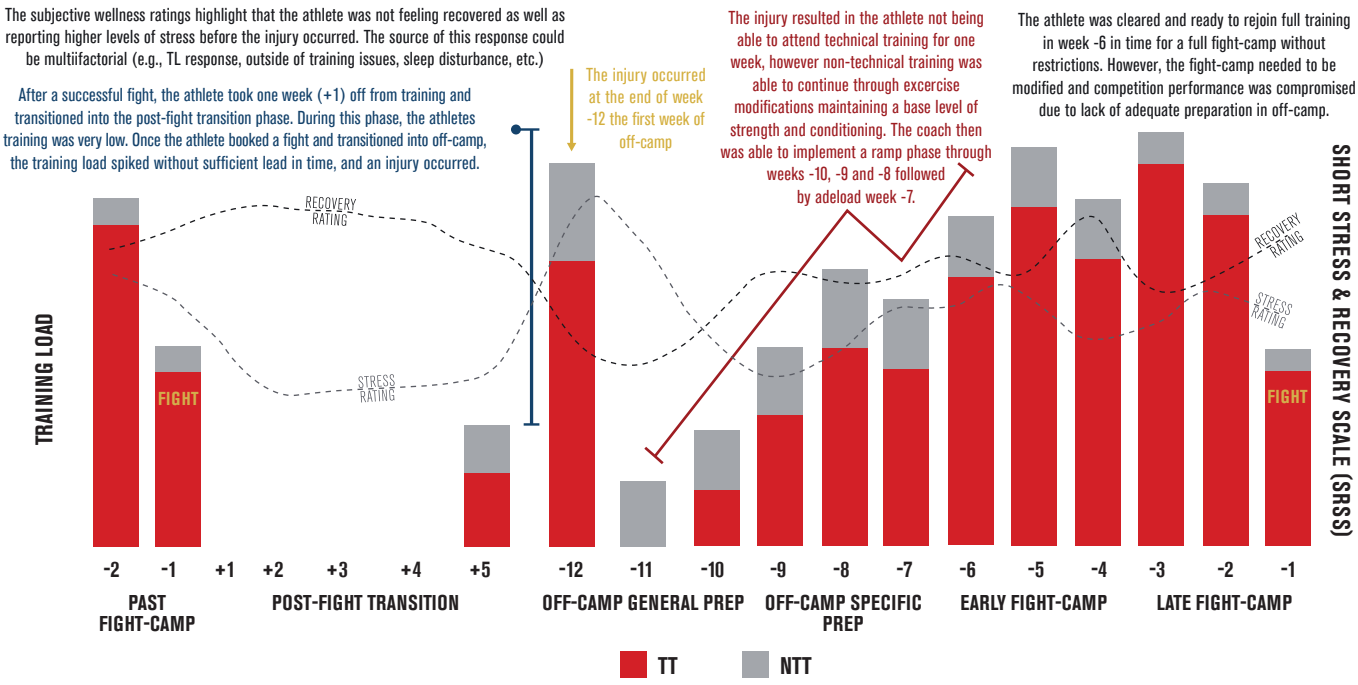
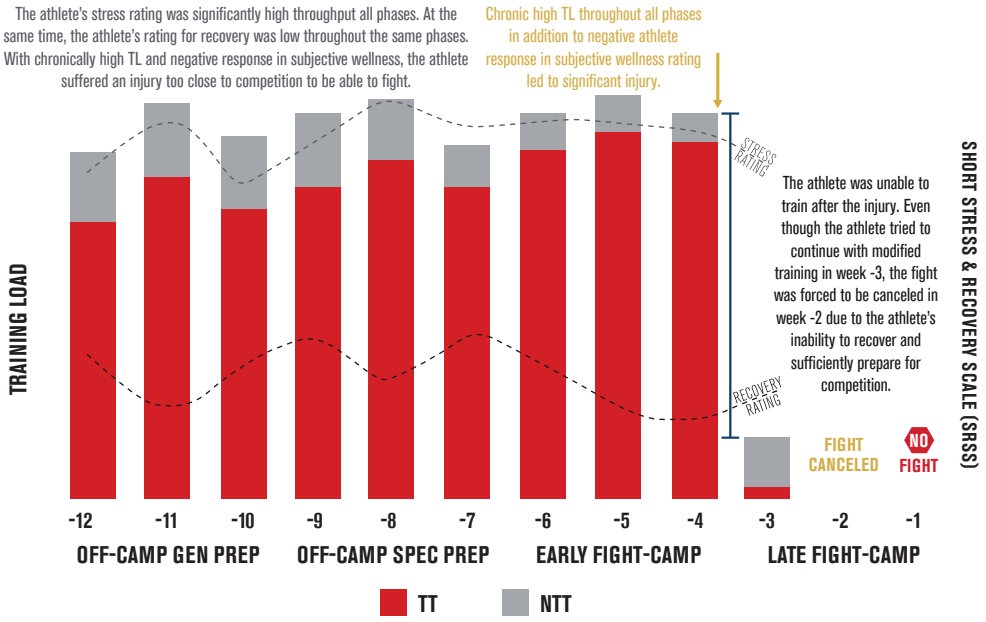


FIGURE 39.3

PROLONGED HIGH CHRONIC LOAD CAUSING INJURY DURING FIGHT PREPARATION LEADING TO A CANCELED BOUT

SCENARIO C: CHRONIC HIGH TL | SUBJECTIVE WELLNESS SHOWED NEGATIVE SIGNS | UNABLE TO SUFFICIENTLY PREPARE FOR COMPETITION | FIGHT CANCELED





It is recommended coaches consider training load "spikes," "troughs" and chronically high levels across three inter-related areas: i) biomechanical, ii) physiological and iii) cognitive load. Biomechanical load is the load on the joints and muscles from training. It includes any tissue damage associated with MMA from, for example, absorbing strikes or being taken down in a grappling situation. If biomechanical load acutely and/or chronically exceeds an individual athlete's capacity, the risk of strains, sprains, cartilage damage and bone fractures among other injuries are theoretically higher. For MMA, the most common injuries in competition (see Section 2), the technical emphasis of the overall MMA program and the weight class of the athlete should be considered with respect to biomechanical load. For example, a wrestling-dominant MMA program may want to monitor and adjust load on the neck and lower spine for some fighters. Meanwhile, heavyweight fighters may want to choose non-weight bearing conditioning for lower load on lower-body joints like the knees. Similar to biomechanical load, if physiological load acutely and/or chronically exceeds an individual athlete's capacity, illness risk (e.g., upper respiratory tract infections) seems more likely to occur. Lastly, cognitive load is relatively new to being considered an aspect of training load but it may moderate the relationship between both biomechanical and physiological training load with injury/illness (e.g., academic stress along with emotional stress or traits, like anxiety or "self-blame") seem to increase the risk of injury.

There are also other moderators of training load and its relationship to injury and illness. A better technical prowess (e.g., better biomechanical performance of a MMA technique), no previous injury, enhanced readiness to train (e.g., increased heart rate variability), greater physical ability (e.g., higher levels of speed, strength, endurance and flexibility), optimized body composition (e.g., an optimal body fat range) and ideal nutrition (e.g., adequate calories for performance composition goals) would all seem to lower injury and illness risk. Anthropometrics (e.g., limb/torso lengths relative to height) and menstruation may also need to be considered as moderators of training load for athletes. Improving these moderators in fighters, where coaches are able, will theoretically make the athlete more resilient to injury and illness at any given training load or change in training load. Likewise, not devoting adequate attention to these moderators of training load may lead athletes to be more susceptible to injury or illness.

FREQUENTLY ASKED QUESTIONS ON TRAINING LOAD AND INJURY AND ILLNESS RISK

1. If a fighter manages training load well, will they never have any injuries or illness?

Unfortunately, the nature of MMA means injuries will occur. However, monitoring and managing a fighter's training load will help to reduce the risk of unnecessary injuries or illness and should also limit the impact of those injuries and illnesses.

2. Should a fighter always keep week-to-week change in training load below 10 percent to avoid "spikes" in training load?

Increasing week-to-week change in training load by no more than 10% is a good rule-of-thumb for fighters and their coaches. However, there will be situations where it may be appropriate for a coach to increase the weekly change in training load by more than 10 percent. These include when a fighter is returning to training after a break and when a coach may strategically want a week with higher volume or intensity in training for some specific purpose. The weekly change in training load also needs to be contextualized with training load moderators. As mentioned, these moderators include a fighter's readiness to train measures and his or her training history. For example, a fighter who has better readiness measures (e.g., subjective wellness or heart rate variability) may tolerate a 15 percent increase in weekly training load, whereas a fighter with worse readiness measures may not be able to tolerate a 5 percent increase. Meanwhile, a fighter who has a history of high chronic levels of training load and is currently training at 50 percent of those levels may be able to easily handle a 20 percent increase in training load from one week to the next.

3. What training load measures should a coach consider to help manage the risk of injury?

A coach should try to create as best as possible overall representation of the state of the fighter before making decisions on training to reduce injury or illness risk. This means a single training load measure (e.g., acute-to-chronic-workload ratio) should not be used as a non-negotiable tool for modifying training. Rather, training load monitoring should investigate the acute and chronic training loads levels, their interaction (e.g. Training Stress Balance) and week-to-week change in total training load. These variables should be considered for both internal (e.g., "how did the fighter respond to the training?") and external (e.g., "what did the fighter do in the training?") training load. The interaction between internal and external training load should also be examined along with readiness to train measures (e.g., "how does the athlete present today?"). These concepts are outlined in further detail in Sections 20 and 22.





PART 2

SECTION 40



SECTION 40: SELF-CARE: INJURY PREVENTION METHODS

By Alice Ai and Matthew Crawley

The physical demands that fighters endure in training and competition requires a high level of resiliency against injury. Injuries can result in days missed from training, poor performance, missed fights and even an early retirement from MMA. In order to reduce the risks of injury and improve resiliency, we suggest athletes use a series of self-care injury prevention strategies. These injury prevention strategies would normally be led by the physical therapist and/or strength and conditioning coach.

SELF-DIRECTED REMEDIAL PROGRAM

A self-directed remedial program should be based on the functional limitations MMA fighters have orthopedically. These limitations may arise from MMA training demands (e.g., tight pectoral muscles and shoulders from the rounded shoulder position desired for striking), previous injuries (e.g., poor kicking power and range of motion due to a previous groin tear), along with other factors. As such, a self-directed remedial program should be based on a fighter's orthopaedic screening results and past injury history and aim to restore and improve the fighter's strength, range of motion, proprioception and postural control. Proprioception in particular, may be an important part of a self-care remedial program considering the link between concussion and subsequent injury and the nature of MMA. The self-directed remedial program can be used as a preparation before training sessions or as a cool-down after training on a regular basis. An example of two different self-directed remedial programs for the hip and the shoulder are provided in Table 40.1.

EDUCATION

It is important that athletes are educated on tissue healing, inflammation mechanics and pain theory. In regard to pain theory, this is normally focused on the differences between pain and soreness and how they relate to their joint function on daily basis. This will help fighters self-monitor their symptoms and seek help if their symptoms reach a certain bandwidth. Alongside education of pain and soreness, athletes should also be educated on fatigue management and how that relates to any athlete monitoring measures in place (e.g., training load, subjective wellness measures and heart rate variability.)

SUPPORT MECHANISMS

Support mechanisms, like taping and strapping during training, can be used to prevent current acute injuries from being re-aggravated while also allowing them to heal when a fighter continues to train. These support mechanisms can also be used to manage chronic issues. For example, with a fighter who has had repeated ankle sprains strapping the ankle before the session would provide stability for the ankle, protect him or her from re-injury and would provide more confidence to perform in training.



TABLE 40.1

AN EXAMPLE OF TWO DIFFERENT REMEDIAL PROGRAMS THAT A FIGHTER MAY BE GIVEN TO HELP IMPROVE JOINT FUNCTION AND REDUCE THE RISK OF INJURY

PROGRAM 1 - HIP		
MOBILITY	Quadruped adductor T-spine rotation	10 each side
	Quadruped hip controlled articular rotations	5 each side
	Shin box - hip wiper	10 each side
DYNAMIC ACTIVATION	Cook hip lift	10 each side
	Side-lying abduction	10 each side
	Side-lying adduction	10 each side
MOVEMENT PREPARATION	World's greatest stretch with lateral squat shift	10 each side
	Crawling pattern (forward & back, left & right)	10 each way
	Sit outs	10 each side
PROGRAM 2 -SHOULDER		
MOBILITY	Scapular controlled articular rotations	10 each side
	Glenohumeral joint controlled articular rotations	10 each side
	Shoulder corkscrew combinations	10
DYNAMIC ACTIVATION	Plank scapular push-ups	15
	Bent-over Y-raise	15
	Bent-over row to external rotation	15
MOVEMENT PREPARATION	World's greatest stretch with lateral squat shift	10 each side
	Crawling pattern (forward & back, left & right)	10 each way
	Wall angel	10
	Sit outs	10 each side





PART 2
SECTION 41

SECTION 41:
WHAT IS SKIN INFECTION?
VIRAL VS FUNGAL VS BACTERIAL

By Robert Gaisfor



VIRAL (HERPES GLADIATORUM OR "MAT HERPES")

Herpes Gladiatorum is the most common viral infection because it is highly contagious through skin-to-skin contact. Around 25 percent of the population has herpes gladiatorum, but only 3 percent know they have it. The first outbreak may present with fatigue, fever and sore throat. Common areas of breakout are the face, hands and fingers. Recurrent breakouts are smaller, do not have systemic symptoms and occur during high-stress times because of a compromised immune system (e.g., fight-camp). Symptoms usually occur within eight days of exposure.



Treatment

- Treatment of mat herpes consists of anti-viral medication (e.g., Valacyclovir) for both primary and recurrent outbreaks.
- Recurrent outbreaks usually occur with high stress (e.g., fight-camp/week, periods of high personal stress) or from direct skin-to-skin contact with someone who is infected. Prophylactically taking medication during these times (i.e., taking the medication to prevent outbreaks when there are none present) reduces risk of outbreak by 90 percent.
- With the difficulty of covering common breakout areas (e.g., face, hands,and fingers), return-to-sport recommendations are:
    - o No new clusters for 48 hours
    - o A firm crust over lesions
    - o Antiviral medication
    - o Herpes infections are highly contagious from skin-to-skin contact (30 percent more likely to give to or receive from a training partner). Ocular (i.e., eye) involvement can cause decreased vision and possible blindness.
- Apply DuraDerm Sport two to three times daily.



FUNGAL (RINGWORM, ATHLETES' FOOT)

Fungal infections are the most common in fighters because infections thrive in moist environment. There is around a 60 percent occurrence rate within combat athletes.



Treatment

- Treatment of fungal infections can be done with over-the-counter medications.
- Good antifungal creams consist of potassium hydroxide formulate (e.g., Lotrimin or clotrimazole cream) applied two to three times a day.
- Fungal infections grow in dark, moist areas. Properly drying skin and equipment is a must.
- Training recommendations are as follows:
    - o Limited contact
    - o 48 hours of antifungal treatment
    - o Covering of lesion(s)
    - o Preventative measures are highly effective in decreasing risk and mitigating infection.
- Apply DuraDerm Sport two to three times daily.

"IF YOU SEE SOMETHING, SAY SOMETHING. CALL YOUR TRAINING PARTNERS OUT."





BACTERIAL (STAPHYLOCOCCUS AND STREPTOCOCCUS)

Bacterial infections are the second-most common infection in fighters. If untreated, bacterial infections can develop into methicillin-resistant staphylococcus aureus (MRSA). Around 75 percent of athletes are MRSA carriers, which makes them seven times more likely to have a bacterial infection and twice as likely to suffer second infection within six months of initial infection.

Treatment

- Limit contact with training partners until there are no new lesions for 48 hours and/or 48 hours of antibiotics.
- Covering the lesion(s) with Bioclusive is recommended until tissue normalizes, but this is not sufficient for training within the initial 48 hours.
- Oral and/or topical antibiotics are generally prescribed with a treatment course normally being seven to 10 days. According to research and prescribing doctors, short-term antibiotic use does not affect cardiovascular system.
- Return-to-Sport Recommendations:
  - o No new lesions for 48 hours
  - o Covering existing lesion(s)
  - o Antibiotic treatment for 48 hours
- Apply DuraDerm Sport two to three times daily.

GENERAL TREATMENT CONSIDERATIONS

- Early identification can cut down on treatment and medication times.
- Contact a sports medicine professional to properly identify plan of treatment and coordinate any prescription medications.
- Collaborate with technical and strength and conditioning coaches on any modified training (e.g., the required decrease in technical training may be able to be offset with more strength and conditioning).
- Collaborate with a sports nutrition professional for tactics on weight management due to modified training and infection/immune system support (See supplement section for macro- and micro-nutrient support).
- As part of the UFC Performance Institute's treatment plan, DuraDerm Sport is a Federal Drug Agency (FDA) cleared wound care and infection prevention serum application.
  - The product is an anti-microbial liquid polymer that kills and eliminates drug-resistant bacteria, viruses and fungi upon contact.
  - Once applied to the skin, as the product dries, it creates a flexible, transparent and biodegradable film that seals over the wound.
  - It has been effective for treatment without the use of oral antibiotics.
  - Most effective use is in the prevention and spread of a skin infection.

PREVENTION

- Wash clothes and gear after every practice.
- Shower immediately, or as soon as possible, after training.
- Wash using liquid soap with antibacterial and antifungal properties.
- Do not share hygiene products.
- Make sure gym mats and equipment are cleaned multiple times a day.
- Cover arms and legs when training, if possible, especially with any open cut.
- Use DeraDerm Sport on any open cuts to prevent infection or the initial signs of infection.
- Consider prophylactic use of anti-viral medication (e.g., Valacyclovir) in high-stress times if a fighter has had previous herpes outbreaks.





PART 2

SECTION 42

SECTION 42: INJURY MANAGEMENT: ACUTE CARE

By Paul Holmes



1. Injuries are part and parcel of fighting. The way they are managed by the fighter and his or her support team can impact the fighter's safety and performance.

2. All acute injuries should be managed using the POLICE principle, which focuses on controlling pain and swelling. POLICE is an acronym that stands for: Protection, Optimal loading, Ice, Compression and Elevation. This principle is explained further in Section 83.

3. Swelling is a normal response to injury whereby an increase in circulation causes blood pooling to protect the area. Swelling persisting beyond 72 hours may slow down recovery.

4. Pain is the body's warning signal to let us know that there has been a potential injury. However, the presence of pain does not necessarily reflect the level of tissue damage.

5 NEXT STEPS

Determine function: The range of motion and strength of the affected area

Recognize flags: Disproportionate pain relative to injury severity or numbness or altered sensation (e.g., "pins and needles")

Consult with your doctor or physical therapist if there are significant differences in function compared to the other limb or any "flags."

6

Evaluate and restore function of the injured joint. The first thing to evaluate after pain and swelling is whether the joint can fully bend (flex) and straighten (extend). If so, the next step is to evaluate the joint's ability to resist against external forces (e.g., via a manual muscle test). If these assessments are clear, then body-weight exercises can be performed to further evaluate the injured joint's function. An example of exercise progressions that would be appropriate for assessing the function in the knee after injury are provided in Figure 42.1. Restoring function to the injured joint should then be addressed using the appropriate exercise progression based on the fighter's capabilities.

EXERCISE PROGRESSION MODEL FOR KNEE INJURY

BW SQUAT

↓

BW SPLIT SQUAT

↓

BW LUNGE

↓

SL SQUAT

↓

JUMP

↓

HOP

7

Depending on the severity and nature of the injury, modifying training activities may also be necessary in order to optimize the fighter's recovery. This might mean only training technical skills or choosing exercises that do not aggravate the injury and allow the injured joint to heal. This is explored further in Section 65.

8

As recovery from the injury continues, it is crucial to involve the fighter's complete support team at the earliest opportunity to ensure synergy in managing the injury and ensuring a safe return to training and competition plan is in place.





PART 2
SECTION 43

INJURY MANAGEMENT: RETURN-TO-SPORT PROTOCOL

By Paul Holmes

5 Before being cleared to return to full sparring and competition, it is important to complete physical and performance testing. These should be no less than 90% of your previous strength and power assessments and when compared to the uninjured limb.

4 Progression through these training stages should only occur in a step-by-step manner if there is no re-aggravation of symptoms. Some discomfort and low intensity pain (e.g., no more than 3 out of 10 on a pain scale) can be normal when returning to activity, but it should subside within a few hours and should not be present when waking the following day. Consider the POLICE principles as described in section 83 to assist with injury recovery between training sessions. If pain persists for more than 48 hours or if you experience severe acute pain (above 3 out of 10), consult with your doctor or physical therapist.

3 When returning to technical training, a fighter's strength should be restored to at least 75% of previous strength and power assessments (if this information is available) and at least 75% of the uninjured limb's strength or power. Technical sessions should be progressed gradually from low-moderate intensity, controlled (i.e., the athlete controls the pace of the drill) and predictable (i.e., the outcome of the drill is pre-determined) drills to high intensity, uncontrolled (i.e., the opponent has greater control of the pace) and unpredictable (i.e., the outcome of the drill is not pre-determined) drills, more closely resembling live work (Figure 43.1). The progression through these stages is led by the injured athlete and guided by the coach, physical therapist and strength & conditioning coach.

FIGURE 43.1

STAGE 6	UNCONTROLLED	UNPREDICTABLE	HIGH INTENSITY
STAGE 5	UNCONTROLLED	UNPREDICTABLE	LOW-MODERATE INTENSITY
STAGE 4	CONTROLLED	PREDICTABLE	HIGH INTENSITY
STAGE 3	UNCONTROLLED	PREDICTABLE	LOW-MODERATE INTENSITY
STAGE 2	CONTROLLED	PREDICTABLE	MODERATE INTENSITY
STAGE 1	CONTROLLED	PREDICTABLE	LOW INTENSITY

2 The first aim in most return to sport protocols is to restore full range of motion in the injured joint. After this has been achieved, progressive strengthening of the affected area through the full range of motion is the next aim. This process may be led by a physical therapist (initially) and strength & conditioning coach.

1 Once acute injury symptoms are close to being resolved and the identified clinical markers show improvement (e.g., a fighter with a knee injury presenting with pain on bending the knee with reduced range of movement can now fully bend the knee without pain), it is time to consider return to training.


VISIT
ESPN



PART 2

SECTION 44

SECTION 44: MANAGING CONCUSSION: SYMPTOMS, EVALUATION & DIAGNOSIS

By Heather Linden and Paul Holmes

Sustaining a traumatic brain injury can significantly alter an athlete's life, and given the nature of MMA, this is an important topic that must be considered for a fighter's well-being. A traumatic brain injury, or concussion, results from the rapid acceleration or deceleration of brain tissue within the skull. These rapid movements of brain tissue can lead to damaged brain cells and altered brain function. This damage also causes chemical and metabolic changes within the brain, making it difficult for brain cells to function and can affect numerous systems in the body. In the United States alone, it is estimated that 3.8 million concussions occur each year and only one in six of these get diagnosed. There are a number of symptoms to be aware of if a fighter is suspected of having a concussion.

These can include:

- Headache
- Dizziness
- Fatigue
- Irritability
- Sleep disturbances
- Memory impairment
- Anxiety
- Sensitivity to noise and light
- Depression
- Blurred vision
- Feeling like in a "fog" or just don't feel "right"

There are also a number of more severe "red flag" symptoms that might need immediate medical attention if a fighter is suspected of having a concussion. These can include:

- Sudden and intense headaches
- Difficulty talking, finding the right words or slurred speech
- Unusual behavior, increased confusion or can't recognize people or places
- Difficulty swallowing
- Loss of consciousness
- Seizures
- Vomiting
- Weakness and numbness in any part of the body
- Very drowsy or unconscious
- Watery or bloody discharge from nose and/or ears

Concussion symptoms can last anywhere from a few days to a few months depending on the severity of the brain injury. After a suspected concussion, it is important to follow up with a licensed medical provider within 24 to 48 hours to steer the athlete in the right direction for recovery. Medical involvement becomes extremely important if symptoms persist more than 10 to 14 days. There are various types of concussions that athletes can experience, and treatment should be individualized depending on symptoms that they are experiencing. With a thorough evaluation and the proper classification of the concussion type, the fighter's management and rehabilitation can be much improved.

A thorough evaluation following a concussion should include:

- Detailed history: injury mechanism, past concussion history (number, recovery course and time between injuries)
- Presence of pre- or co-morbid conditions: learning disabilities, attention deficit disorder, motion sickness or sensitivity, mood disorders, migraine or headache disorders
- Current medication use
- Cranial nerve exam (See Table 44.1)
- Cervical spine exam: palpation, range of motion, neck and upper-body strength, reflex and sensation tests (e.g., Hoffman test), cervical special tests (e.g., Spurling's test)
- Neurocognitive testing: incident tests (e.g., relevant components of C3Logix, Impact, SCAT-5 and compare to baseline data if available).

After an evaluation is performed, the category of the concussion should be determined. It should be noted that concussions can fall under more than one category, and treatment might need to overlap categories in order to achieve full resolution of symptoms. Table 44.2 lists and explains the main categories of concussions, along with possible further tests to better understand how symptoms can be resolved. After the concussion has been correctly categorized, it is time to establish an individualized care plan and collaborate with that fighter's entire support team to return to play safely without jeopardizing health and well-being.



TABLE 44.1

A LIST OF CRANIAL NERVES AND THEIR FUNCTION FOR SUSPECTED CONCUSSION EXAMINATION PURPOSES

CRANIAL NERVES	BODY PART	FUNCTION
Olfactory	Nose	Smell, identifies odors
Optic	Eyes	Peripheral vision-loss of vision
Oculomotor	Eyes	Peripheral vision-eye chart, reaction to light-pupillary reflex
Trochlear	Eyes	Able to turn eye downward and lateral/double vision
Trigeminal	Face	Face sensation, clench teeth/biting and chewing
Abducens	Eyes	Looking to each side-past midline/double vision
Facial	Face/Tongue	Facial expressions and taste
Vestibulocochlear	Ear	Hearing/Balance
Glossopharyngeal	Tongue/Tonsils/Ear	Swallowing
Vagus	Heart/Lungs/Stomach	Parasympathetic fibers to organs/heart rate, sweating, speech
Accessory	Neck	Shrug shoulders, controls neck muscles and turns head
Hypoglossal	Tongue	Motor control of the tongue

TABLE 44.2

DIFFERENT TYPES OF CONCUSSIONS, THEIR EXPLANATION AND FURTHER TESTS TO BETTER UNDERSTAND TYPES OF CONCUSSIONS

CATEGORY	EXPLANATION	FURTHER TESTS
VESTIBULAR	Occurs when parts of the brain and inner ear that help control balance and eye movements are affected	BPVV/Dix-Hallpike maneuver, balance error scoring system, functional gait index, functional gait assessment
OCULAR-MOTOR/ VISION	Occurs when there is an absence or defect of controlled, voluntary and purposeful eye movements (like reading, writing, finding an object)	Smooth pursuit, saccades, antisaccades, convergence, visual accomodation, vestibulo-occular reflex, dynamic visual acuity test, King-Devick test, H-testing, static visual acuity, Brock strings, depth perception
CERVICOGENIC	Pain from upper cervical spinal cord referring to regions of the head, pain in neck region	Cervical spine and head evaluation, temporal-mandibular joint evaluation
MIGRAINE/ HEADACHE	Occurs from muscles tensing or blood vessels narrowing keeping blood from your head. Can cause nausea and vomiting, pulsing pain or sensitivity to light	Cervical spine and head evaluation, temporal-mandibular joint evaluation
ANXIETY-MOOD	Right-sided brain hemisphere injury: Attributed to poor brain processing speeds which exacerbates mood disorders	Questionnaires
COGNITIVE	Affecting a person's thinking	Reaction time, working memory, memory retrieval, short term memory, attention


UFC
UFC



PART 2
SECTION 45

SECTION 45: CONCUSSION: RETURN-TO-SPORT PROTOCOL

By Heather Linden, Paul Holmes, Matthew Crawley, Forrest Griffin and Dean Amasinger

For physical injuries, you can return to sport once you are pain-free, have no swelling and you are at least 90 percent of your strength, power and range of motion compared to your uninjured side and/or previous assessments. However, for brain injuries like concussion, even if you are feeling symptom-free, a fighter should go through all stages of a return-to-sport protocol to ensure a full brain recovery. Further, resuming activity too quickly, especially in contact sports like MMA, not only increases the risk of subsequent musculoskeletal injuries and longer recovery times but also further concussions (e.g., second-impact syndrome) which can lead to chronic neurological conditions, permanent disability and death.

In the first 24 to 48 hours after a concussion, physical and mental rest is the most appropriate way to allow the brain to recover. Although lying in a dark room, staying awake all night and avoiding all stimuli is not necessary, activities that require high mental concentration (e.g., playing video games, watching television, texting or computer work) should be limited. Physical activities that exacerbate any of the concussion symptoms should also be avoided. If there are any headache symptoms with the concussion, it is recommended that acetaminophen (e.g., Tylenol) be the ONLY medication used for pain relief. Other pain relievers such as ibuprofen (e.g., Advil, Motrin) and aspirin should be avoided as these medications may increase the risk of bleeding in the brain. If symptoms worsen in the first 48 hours and/or if there are any of the "red flag" symptoms mentioned in Section 44, it is important to contact a medical provider immediately.

After the initial 24 to 48 hours of rest, a gradual increase in activity is recommended along with regular consultations with a health care provider. The health-care provider should ideally use symptom presentation along with a concussion assessment tool (e.g., SCAT-5, C3Logix) to help guide and progress each phase of a fighter's return to sport. Due to recent research suggesting there are cognitive impairments in previously concussed athletes after exercise when none may be present at rest, we recommend the concussion assessment tool is also applied after exercise in the latter stages of the return to sport for a fighter. The UFC Performance Institute return to sport protocol is outlined in Figure 45.1. It should be noted that if concussion symptoms do arise during any of these progressions, the fighter should rest and be symptom-free for at least 24 hours before returning to training. Then when returning to training, the fighter should also be regressed to the step prior to where the symptoms occurred (e.g., if the fighter experienced symptoms in Stage 4 of the return-to-sport protocol, they would rest until they were symptom-free for 24 hours and resume training at Stage 3) and initially limit the fighter to a maximal heart rate of 90 percent of the heart rate where symptoms occurred. Provided symptoms continue to improve and any setbacks in each phase are managed appropriately, a safe healthy return for the fighter should be accomplished.

FIGURE 45.1

RETURN-TO-SPORT PROTOCOL

1

STAGE 1: INITIAL RECOVERY

- 24 to 48 hour symptom management
- Acetaminophen (Tylenol/Paracetamol) only. NO Ibuprofen
- Mental and physical rest
- Allowed to sleep
- If change in behavior or "red-flag" symptoms, send athlete to hospital
- No activities that require mental concentration (e.g., screen time)

2

STAGE 2: NO CONTACT I

- Check daily symptom score from concussion assessment tool (e.g., SCAT-5)
- Mild symptoms (Scores <3) able to start activity
- Physical therapy based on type of concussion five times per week
- Post-exercise symptom check, and…
- …If symptom-free, progress to next stage
- Use heart-rate monitor to gauge intensity, if available

Stage 2.1 Aerobic Training - Low Intensity

- 15 to 20 minutes, plus warm up and cool down
- Target heart rate <70 percent of maximum or rating of perceived exertion (RPE) below moderate on CR-10 scale
- Exercise mode: walking, cycling

Stage 2.2 Aerobic Training - Moderate Intensity

- 15 to 30 minutes, plus warm up and cool down
- Target heart rate 70-80 percent or sessional rating of perceived exertion or rating of perceived exertion (RPE) ~moderate on CR-10 scale

Stage 2.3 Technical Training – Low-Intensity Drills

- 15 to 30 minutes, plus warm up and cool down
- Light MMA drills with no risk of any head contact (e.g., shadow boxing, foot-work drills, skipping, Brazilian jiu-jitsu warm-up movements or line drills with no partner)
- No drills that involve inversion (e.g., forward or backward rolls) or pressure on the neck
- No wrestling drills that involve contact with a partner (e.g., pummeling)
- 60 percent perceived intensity level, target heart rate 60-80 percent of maximum or RPE below moderate on CR-10 scale for controlling intensity

3

STAGE 3: NO CONTACT II

- Check daily symptom score from concussion assessment tool (e.g., SCAT-5)
- Symptoms equal to baseline (Score 0) able to continue activity
- Physical therapy based on type of concussion three to five times per week
- Post-exercise symptom check, especially for going from supine or prone to standing or for upper-body vibration to neck with bag work
- If symptom-free, progress to next stage
- Use heart-rate monitor to gauge intensity, if available

Stage 3.1 Strength Training – Low Intensity

- Low to moderate intensity strength training
- ~50-75 percent one repetition maximum (1RM) in loaded multi-joint movements, auxiliary and core work (no maximal effort or plyometrics), plus warm up and cool down
- RPE below moderate on CR-10 scale for controlling intensity

Stage 3.2 Strength Training - Moderate Intensity

- Moderate-intensity strength training
- ~75-85 percent 1RM in loaded multi-joint movements, auxiliary and core work (no maximal effort or plyometrics), plus warm up and cool down
- RPE below hard on CR-10 scale for controlling intensity

Stage 3.3 Technical Training – Low-Moderate Intensity Drills

- 20 to 40 minutes, plus warm up and cool down
- Light-moderate MMA drills with no risk of any head contact (e.g., as in previous stages, plus striking bag work, Brazilian jiu-jitsu or wrestling drills: sprawls, get-ups and pummeling) with no or controlled partner, no takedowns and no resistance
- No drills that involve inversion (e.g., forward or backward rolls) and pressure on the neck
- 60-70 percent perceived intensity level, target heart rate 60-80 percent of maximum or RPE light to moderate on CR-10 scale for controlling intensity

***Recommended guidelines should be managed by a licensed healthcare provider.**

4

STAGE 4: MODERATE CONTACT

- Check daily symptom score from concussion assessment tool (e.g., SCAT-5)
- Symptoms should be equal to baseline (Score 0) after exercise test (20-minute cycle at 80 percent of maximum heart rate) to continue activity
- Physical therapy as needed based on type of concussion
- Post-exercise symptom check, especially for going from supine or prone to standing, for upper-body vibration to neck with bag or mitt work and for jumping or plyometric efforts
- If symptom-free, progress to next stage
- Use heart-rate monitor to gauge intensity if available

Stage 4.1 Interval Training - Moderate-High Intensity

- 30 to 45-second intervals recovering to heart rate ~120 beats per minute (or a work:rest ratio of 1:3 if heart rate monitors are not available) for 30 minutes maximum
- Target heart rate 80-90 percent of maximum or RPE ~hard on CR-10 scale during work bouts
- Exercise mode: rowing ergometer, ski ergometer, and VersaClimber

Stage 4.2 Strength Training - High Intensity

- High-intensity strength training
- ~85-95 percent 1RM in loaded multi-joint movements, auxiliary and core work with plyometric efforts, plus warm up and cool down
- Stage 4.2 Technical Training - Moderate-Intensity Drills and Low-Intensity Live Work
- 15 to 40 minutes, plus warm up and cool down
- Moderate MMA drills with little risk of any head contact (e.g., as in previous stages, striking mitt work with coach, short-duration live Brazilian jiu-jitsu positional work: when start position results in an escape, sweep, or tap, stop and return the start position with no scrambles), controlled wrestling drills (e.g., controlled wrestling takedowns from standing to ground)
- Include a limited amount of drills that involve inversion (e.g., forward or backward rolls) and pressure on the neck
- 75 percent perceived intensity level, target heart rate 60-90 percent of maximum or RPE ~hard on CR-10 scale for controlling intensity

5

STAGE 5: RETURN TO FULL CONTACT

- Check daily symptom score from concussion assessment tool (e.g., SCAT-5)
- Symptoms should be equal to baseline (Score 0) after exercise test (20-minute cycle at 80 percent of maximum heart rate) to continue activity
- Medical clearance from a physician must be completed before being cleared to return to contact
- Physical therapy as needed based on type of concussion
- Strength and conditioning program to resume as normal
- Post-exercise symptom check, especially for going from supine or prone to standing, for upper-body vibration to neck with bag or mitt work and for jumping or plyometric efforts
- If symptom-free, progress to next stage

Stage 5.1 Technical Training – Moderate-Intensity MMA Drills and Low-Intensity Live Work

- 30 to 45 minutes, plus warm up and cool down
- Moderate MMA drills with moderate risk of any head contact (e.g., as in previous stages, striking partner drills: Dutch drills or other controlled one-for-one drills), increased duration live Brazilian jiu-jitsu positional groundwork with no scrambles, wrestling drills at higher intensity
- Include an increased amount of drills that involve inversion (e.g., forward or backward rolls) and pressure on the neck
- 80 to 85 percent perceived intensity level or RPE ~hard to very hard on CR-10 scale for controlling intensity

Stage 5.2 Technical Training – High-Intensity Drills and Moderate-Intensity Live Work

- 30 to 60 minutes, plus warm up and cool down
- Moderate to high-intensity MMA drills with moderate risk of any head contact (e.g., as in previous stages, striking partner drills: increase speed and longer duration), longer duration live Brazilian jiu-jitsu positional groundwork with scrambles, wrestling drills for longer duration
- Include an increased amount of drills that involve inversion (e.g., forward or backward rolls) and pressure on the neck
- 90 percent perceived intensity level or RPE ~hard to very hard on CR-10 scale for controlling intensity

Stage 5.3 Technical Training – Return to Sparring

- High-intensity MMA drills with moderate to high risk of any head contact (e.g., as in previous stages, live wrestling)
- Include an increased amount of drills that involve inversion (e.g., forward or backward rolls) and pressure on the neck
- 100 percent perceived intensity level
- Start with one sparring session per week with no more than three rounds of five minutes
- Progressively add rounds over the course of four weeks until you reach two full sparring sessions of five rounds in each session


Giselle



PART 2

SECTION 46

SECTION 46: SPECIFIC PREPARATION: TECHNICAL TRAINING SESSION PLANNING

By Dean Amasinger and Felix Falkenberg

TABLE 46.1
EXAMPLE THREE-WEEK MESOCYCLE IN OFF-CAMP SPECIFIC PREPARATION

	OFF-CAMP SPECIFIC PREPARATION		
	-9	-8	-7
COACH PLANNED	MODERATE	HIGH	LOW
COACH INTENDED sRPE	4.2 ± 1.2	4.4 ± 1.0	4.2 ± 1.6
LIVE : DRILL	20% : 80%	22% : 78%	23% : 77%
TOTAL LIVE RD	38	48	28
TT:NTT DISTRIBUTION	80% : 20%	77% : 23%	79% : 21%

Technical training in the specific preparation phase should focus on integrating and combining the individual techniques that make up the 11 technical categories. The technical evaluation is still the guide for which techniques to focus on, but there is added tactical focus. The increased tactical focus is a natural consequence of the integration of the individual technical categories. However, the increase in tactical focus may need to be balanced with a fighter's skill-acquisition ability. Due to skill acquisition normally being a non-linear process, there may be times where it is necessary to regress and refocus on individual techniques of the technical categories that underpin its use in MMA and forgo tactical work until this is accomplished. There should also be a shift toward developing the energy systems most relevant to the demands of MMA, and training sessions can complement any non-technical conditioning a fighter completes.

Again, this can be planned for and monitored by using a ratio of live:drill work in training sessions, shorter duration sessions and the coach's intended ratings of perceived exertion for the athletes in training sessions (sRPE). An example of a specific preparation three-week cycle with different live:drill ratios and coach-intended sRPE across the weeks are detailed in Table 46.1.

In the specific preparation phase, there is a greater emphasis on live work, and the average intended session rating of perceived exertion should normally be higher than in general preparation but lower than fight-camp. This is reflected in a higher live:drill ratio. Furthermore, the TT:NTT distribution shifts toward technical training as the specificity increases and the time is realocated to live work. The mindset around learning is still promoted and a fun, experimental approach should be encouraged. Athletes should work their way through the technical and tactical challenges as their mental representations of skills increases.

An example of an individual training session that prioritizes a technical area (in this case, fence wrestling) during specific preparation is provided in Figure 46.2. This session plan has been progressed from general preparation (see Figure 29.2) with a greater amount of live work, along with a higher coach intended intensity.

FIGURE 46.2

EXAMPLE MODERATE-HIGH INTENSITY FENCE WRESTLING TRAINING SESSION (COACH INTENDED SRPE - 5)

WEEK 1
DATE:
START TIME 09:00
SESSION LENGTH: 107

SPECIFIC PREPERATION: FENCE WRESTLING

SESSION MINDSET: EXPERIMENTAL

EQUIPMENT REQUIRED: 8OZ GLOVES, MOUTH PIECE, CUP

DRILL TIME	DRILL	DETAILS	COMMENTS	INTENSITY
10	MOVEMENT MOBILZATION ACTIVATION (MMA)	GAV		
7	BJJ DRILLS	5 MIN 2 MIN REST	ATHLETE LED	
10	PARTNER LED - DOUBLE	9 MIN 1 MIN REST	RANDOM NOT IN SEQUENCE	
6	LIVE - IN ON A DOUBLE (FLAT)	2 X 2 MIN 1 MIN REST	IN PAIRS. SWITCH AFTER 2 GOES	
10	PARTNER LED - DOUBLE	9 MIN 1 MIN REST	RANDOM NOT IN SEQUENCE	
6	LIVE - IN ON A DOUBLE (W/ UNDERHOOK)	2 X 2 MIN 1 MIN REST	IN PAIRS. SWITCH AFTER 2 GOES	
10	PARTNER LED - DOUBLE	9 MIN 1 MIN REST	RANDOM NOT IN SEQUENCE	
6	LIVE - IN ON A DOUBLE (W/ STRIKES)	2 X 2 MIN 1 MIN REST	IN PAIRS. SWITCH AFTER 2 GOES	
10	SHEPHARDING	10 MIN 1 MIN REST	START FROM 10 FEET FROM FENCE	
6	LIVE - FROM OPEN	2 X 2 MIN 1 MIN REST	IN PAIRS. SWITCH AFTER 2 GOES	
5	VISUALIZATION REVIEW			
10	COOL DOWN			
10	VIDEO ANALYSIS & FEEDBACK		Q&A	
107				

SESSION MINDSET TO ALLOW ATHLETE TO SET INTENTION

GLOVES NEEDED FOR PROTECTION BUT ALSO FOR SPECIFCITY OF TRAINING

UNSTRUCTURED DRILLS FROM PREVIOUS DAYS BJJ

CAN BE CHANGED TO FURTHER MANIPULATE CONSTRAINTS AND INTENSITY

BRACKETS DENOTE CHANCE IN CONSTRAINT

TACTICAL APPLICATION OF TECHNIQUES

VISUALIZATION REVIEW TO INCORPORATE BREATHING TECHNIQUES AND MENTAL REPETITIONS OF SESSION TECHNIQUE

IMMEDIATE FEEDBACK, PARTICULARLY OF LIVE WORK. ALSO OPPORTUNITY FOR SELF ANALYSIS AND QUESTIONS





PART 2
SECTION 47

SECTION 47: SPECIFIC PREPARATION: TECHNICAL SKILL DEVELOPMENT

By Dean Amasinger

During the specific preparation phase, skill development is still guided by the technical evaluation, but the emphasis of the coaching points differs to those in general preparation. There is a greater emphasis on the integration and transitions between the technical categories and the context in which they can be used (tactical awareness). In specific preparation, the increased technical competency from the skill development in general preparation allows further athlete autonomy and is guided in a greater capacity by the athlete and their training partners and is less prescribed. This level of autonomy for fighters in sessions is dependent on several factors including i) the technical level and experience of the fighter and ii) if the skill development achieved in general preparation is deemed adequate. Regardless of the level of autonomy, even a little athlete choice in technical development should engage the fighter in the learning process (i.e., increase his or her attention and focus in sessions and increase the perceived relevance of the training session for the fighter). An example of a micro-cycle that has "core," "swing" and "individual" sessions that allow for some fighter autonomy is provided in Figure 47.1.

A TEACHER IS NEVER A GIVER OF TRUTH; HE IS A GUIDE, A POINTER TO THE TRUTH THAT EACH STUDENT MUST FIND FOR HIMSELF." - BRUCE LEE

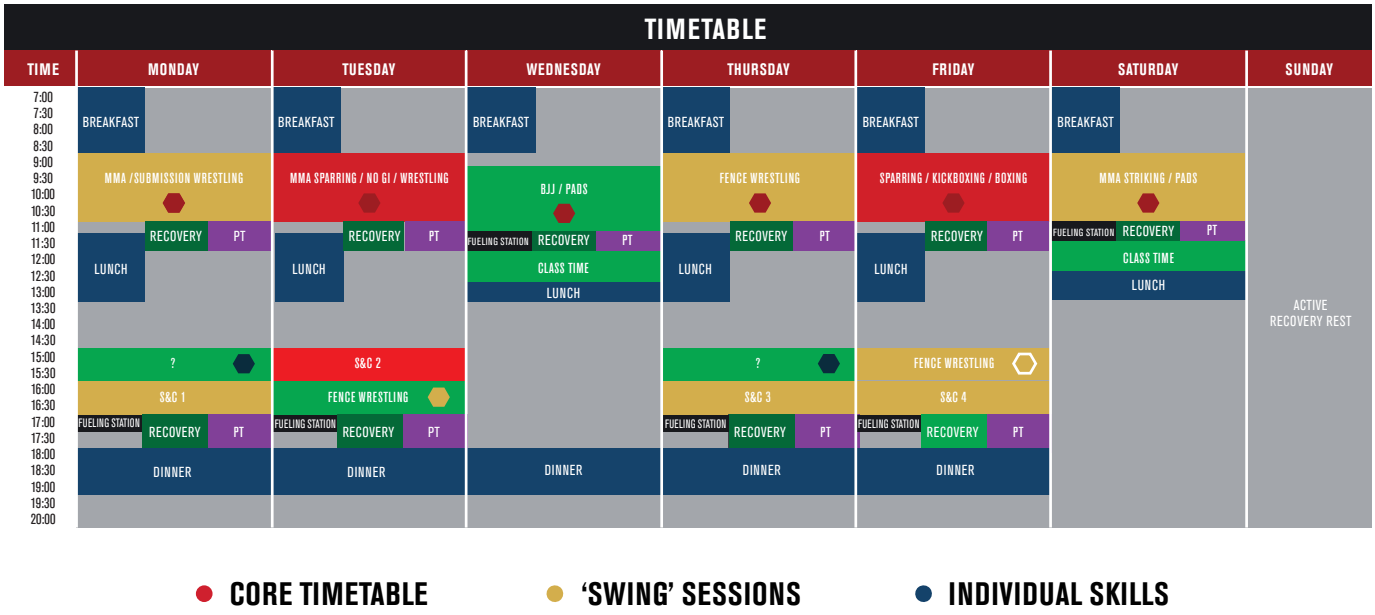
The emphasis and structure of training sessions differ in specific preparation as the specificity of training increases. The "core" timetable is still in place, as are the "swing" sessions. In the example shown in Table 47.1, the "swing" sessions are still focused on fence takedowns as athlete X technical competency develops. Through communication with the coaching staff, individual skill sessions are chosen by the athlete and can be any techniques/tactics the athlete feels he or she needs to work on. The session structure in terms of duration and training load is in keeping with the phase of training and the daily undulation of training load. This engages the athlete in the learning process, thereby increasing the enjoyment of the session, the perceived relevance of the session and the athlete's attention and focus—which are all key components of skill development.

INTER-COORDINATION OF TECHNICAL THEMES

As mentioned previously, it is crucial for skill development to consider how a fighter will get adequate exposure to the skill or technique needing to be developed. Similar to general preparation, this involves thought on how the technical themes for specific preparation are incorporated both within a micro-cycle (For intra-coordination of technical themes, see Section 29 for more examples) and between micro-cycles, known as inter-coordination of technical themes. So, although there is still intra-coordination of technical themes within a micro-cycle as with general preparation, there is also inter-coordination between the technical themes across the meso-cycle. Figure 47.2 provides an example of how a coach could strategically coordinate skill exposure over a three-week meso-cycle in a progression for a fighter who needs to prioritize fence takedowns. The next step for coaches is to consider how to connect this technical theme (e.g., fence takedowns) over the full meso-cycle. In this three-week example, week one could focus on fence double-leg takedowns that may include a technique that finishes with a counter to a cross face with a single-leg takedown. This can be further built upon in week two by contextualizing the sequence and adding to the single-leg takedown. It should be noted that for coaches dealing with a number of fighters in a team setting, the technical themes can still apply regardless of fighting style. A predominant striker could focus on double-leg defense if the technical theme is double-leg takedowns, and a predominant grappler could focus on the takedowns and a mixed style could spread more evenly from the distribution of the swing and individual skills sessions.

As mentioned previously in Section 29, there should also be thought given to how other sessions complement this particular technique or skill focus. With the further integration of technical streams in specific preparation, the MMA striking session could include combinations that fit well for double-leg setups. This isn't to say that other areas of striking may not be touched on, but it can influence the session plan.

FIGURE 47.1
SAMPLE MICRO-CYCLE STRUCTURE IN SPECIFIC PREPARATION



As shown in Figure 46.2, the session is less structured in terms of the coaching points and which techniques are focused on. Instead, it is based on manipulating the constraints around the technique to challenge the skill in imperfect situations. The partner-led drilling sections force the athlete to make real-time decisions (at sub fight speed) in which direction to "chain" to the next technique, making those decisions quicker (if not semi-automatic) when tested under live conditions. The shepherding drill is the introduction of tactics around the techniques that have been developed and further integrates techniques from other technical categories.

With one of the focuses for an athlete being to develop takedowns against the fence, the training week still consists of three fence wrestling sessions. The first is a low-intensity session that is partner-led but with no live work. During the drilling phase, there is coaches' feedback when necessary, but questions are asked during rest breaks between rounds to help the athlete self-evaluate. The second session is detailed in Figure 46.2. The third session is based around the video analysis from session two and any notes or questions that came up during the self-evaluation. This session also has a live aspect.

The volume and nature of coaches' feedback to fighters should also be manipulated in specific preparation. Beyond general preparation when the foundations of the technique have been laid, a conscious reduction in the volume of feedback can help the athlete "find" the technique on his or her own through self-correction and self-reflection. The likelihood of self-correction is increased when the drills used for skill development are implicit, so the outcome of the drill is

FIGURE 47.2
EXAMPLE MESO-CYCLE PROGRESSION FOR FENCE TAKEDOWNS DURING THE SPECIFIC PREPARATION PHASE

WEEK 1	**DOUBLE LEG** Double to Single Double to Body Lock
WEEK 2	**SINGLE LEG** Double to Single to High C Single Leg to Body Lock
WEEK 3	**CLINCH** Single Leg to Body Lock Clinch to Knee Tap

the learning goal. Not every drill lends itself to this idea, but it should be a consideration when designing drills. Furthermore, an external cue emphasis can allow the athlete to focus on the outcome of the technique rather than the details of its execution.

Again, this level of skill exposure and manipulation of coach feedback across meso- and micro-cycles require a high level of logistical planning, fighter observation and coordination between coaches in order to facilitate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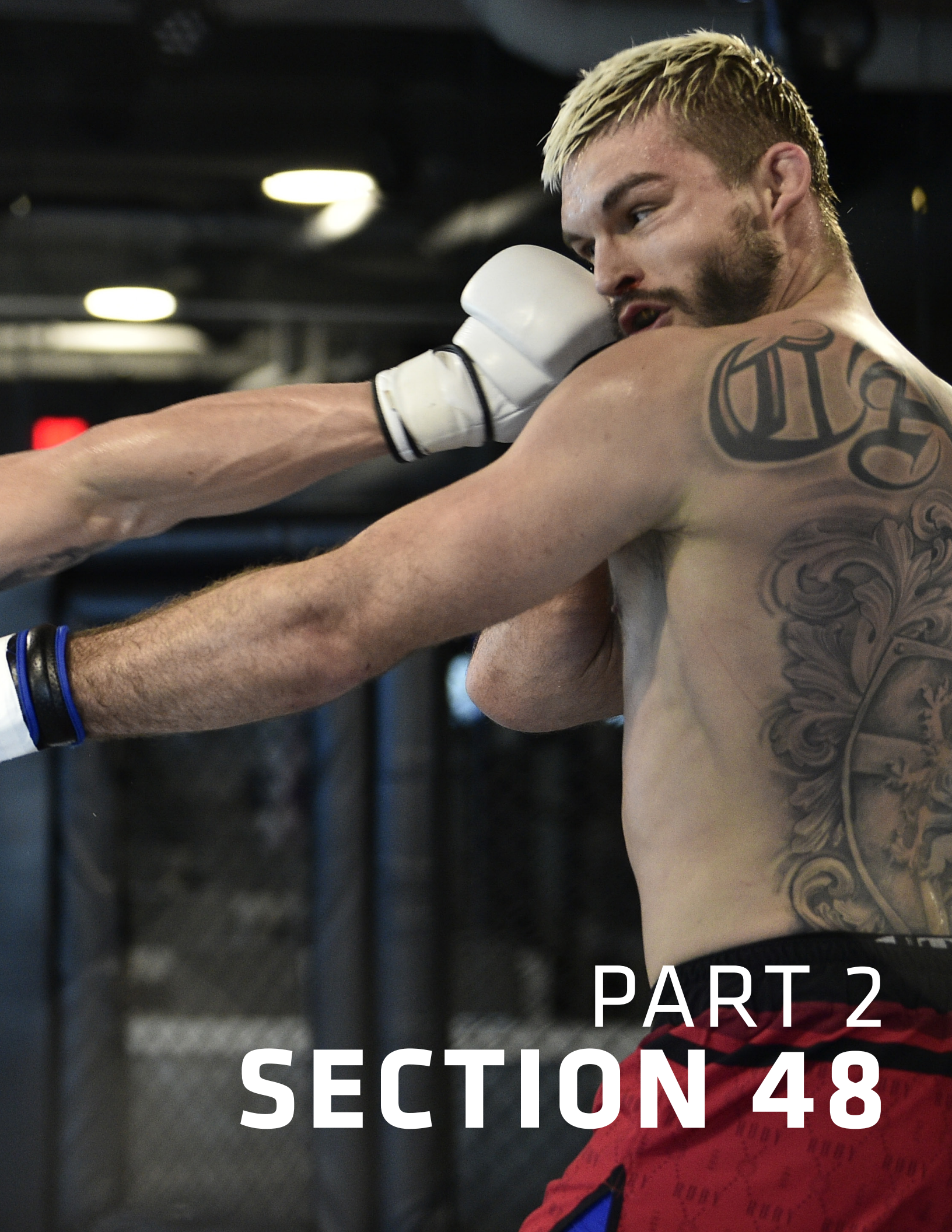


PART 2
SECTION 48

SECTION 48: SPECIFIC PREPARATION: SPARRING CONSIDERATIONS

By Forrest Griffin, Richy Walsh, Dean Amasinger and Felix Falkenberg

Sparring in specific preparation should be tailored to improve broad tactical aspects of MMA and start to combine the individual martial arts skills learned in general preparation. The focus of sparring in specific preparation should also shift to more competitive and realistic fight rounds which will help transfer to competition. The complexity of sparring in specific preparation will also normally increase from general preparation, and this helps to develop the athlete's ability to combine the individual skills learned from general preparation in MMA situations. This increase in complexity is reflected in the types of sparring used during specific preparation. For example, in general preparation, sparring days may include pure wrestling and Brazilian Jiu-Jitsu, whereas in specific preparation, this may change to clinch sparring and ground-and pound get-up rounds. The increase in sparring complexity over a fight preparation can be seen in Figure 48.1. Although we suggest general preparation and specific preparation should include some full MMA sparring rounds, the majority of sparring in the general preparation would normally focus on the individual martial arts. As a fighter moves into specific preparation, these skills from the individual martial arts are then purposefully and intelligently combined by coaches in MMA-specific situations.

The sparring in specific preparation should also be designed in such a way to help build a fighter's confidence by applying the previously learned techniques from the individual martial arts in "tactically-correct" situations. It is also important that during specific preparation, the sparring intensity level should remain at a level where the fighter can still learn and experiment with his or her developing skillset without adversely risking injury. This can be achieved by prescribing and monitoring different intensity levels of sparring to the athletes (See Section 30), along with clear guidelines on the techniques used (e.g., no elbows, knees or spinning techniques to the head), pre-framing (See Table 48.1) and appropriateness of sparring partners (e.g., within one weight class above and below and of an appropriate skill level). Of course, more competitive and higher intensity sparring is needed during a fight preparation. However, too high an intensity in sparring may also inhibit learning new tactics and techniques, and this should be considered by coaches.

In regard to energy systems development, one caveat is that if the general preparation has built adequate levels of conditioning, specific preparation gives an opportunity for coaches to increase the intensity of sparring rounds and potentially lower the recovery time between rounds. Using fresh training partners during sparring rounds may also be an appropriate strategy in this phase. This will normally force a fighter to have a higher work rate during sparring which will improve conditioning, as well as having fighters adapt to different styles under fatigue. This gradual increase in complexity and intensity during specific preparation will allow a fighter to maximize the technical, tactical and conditioning benefits from sparring.

FIGURE 48.1

SPARRING COMPLEXITY OVER A FIGHT PREPARATION

Although not the main focus of sparring, some MMA sparring rounds should be included in the off-camp

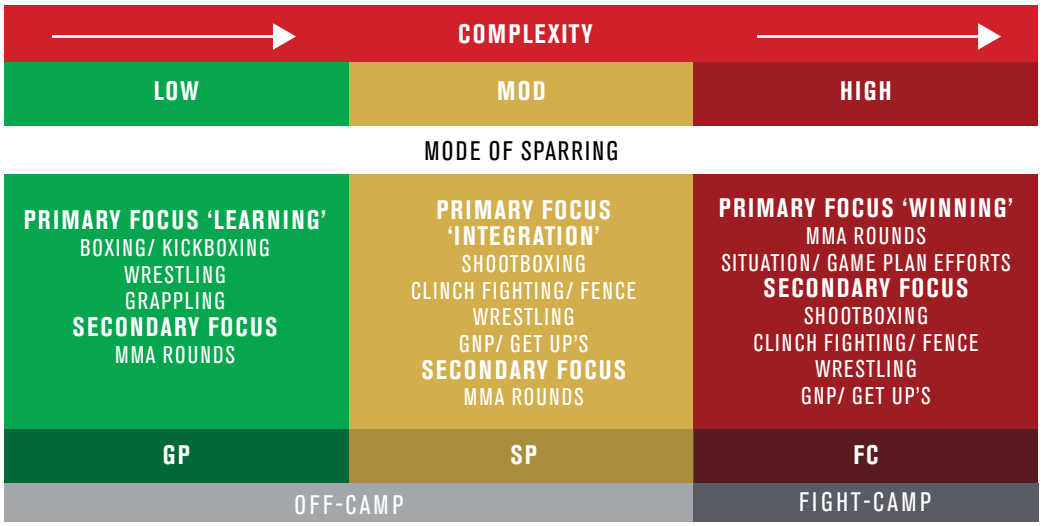


TABLE 48.1

SPECIFIC PREPARATION SPARRING RULES OF ENGAGEMENT

VOLUME	Specific preparation allows a fighter's sparring capacity to be built up through an increasing number of rounds.
INTENSITY	In most cases, the intensity level should be low to moderate (levels 2-3) and at a level that allows for upskilling and learning.
TECHNIQUES	Fighters are encouraged to incorporate recently learned techniques in sparring to foster a learning mindset.
CLOCK DISCIPLINE	It is not necessary to stick to strict rest periods in between rounds. Between sets of different sparring modes (e.g., between boxing and kickboxing or big-glove and little-glove sparring rounds), rest periods can be intelligently utilized.
SPARRING REVIEW	Used by coach and athlete to isolate areas of improvement (e.g., "What can we identify to fix before next sparring session?", consider using subjective or objective feedback, like video).
SPARRING PARTNERS	Should be within one weight class above or below a fighter to avoid injury.
PRE-FRAMING	Prioritize pre-framing designed around situations, recently learned techniques and technical weaknesses.


UFC



PART 2

SECTION 49

SECTION 49: SPECIFIC PREPARATION: NON-TECHNICAL TRAINING PROGRAM DESIGN

By Gavin Pratt

Similar to the non-technical program design in general preparation, we must once again ask the question, "What is the purpose of the specific preparation phase?" Generally for MMA, this purpose is to start fine-tuning the physiological qualities developed in general preparation and readying the fighter for an increase in training intensity during a fight-camp (Figure 49.1). In other words, general preparation underpins the potential for adaptation and specific preparation helps maximize those adaptations for competition. Making sure a fighter is adequately physically prepared within specific preparation will also aid in decreasing the risk of overtraining and injury during a fight-camp. Further, it allows the coach and fighter to focus more on technical training goals, rather than try and catch up to non-technical goals in a fight-camp. Specific preparation will also normally have a greater emphasis on ballistic and velocity-based training compared to the general preparation, however, this will also be dependent on the fighter's individual deficiencies. Figure 49.2 illustrates these differences and the general aim of both general and specific preparation.

Re-assessing the fighter prior to the start of specific preparation is recommended to help re-establish the priorities for upcoming training (e.g., "Does the fighter have a force or velocity deficiency?"). Further, if appropriate assessment improvements or diagnostic changes haven't been made over the general preparation, this can highlight any flaws in non-technical programming that may need to be addressed before moving forward. Training programs can then be tailored toward the specific preparation's desired outcomes, based off these assessments, depending on whether a distinctive quality needs to be improved or maintained. When weighing the needs of an individual fighter and his or her training program design, the increase in ballistic and velocity-based training during specific preparation should also be considered and integrated into the program in a logical manner.

AIM TO BUILD AN ELITE "HOME" FOR YOUR ATHLETE. GENERAL PREPARATION LAYS THE FOUNDATION, SPECIFIC PREPARATION CONSTRUCTS THE WALLS AND THE FIGHT-CAMP RAISES THE HEIGHT OF YOUR CEILING.

It becomes more important in specific preparation to plan non-technical sessions across the week to avoid fatigue and, if possible, potentiate subsequent technical training (as mentioned in Section 17). For example, the strength and conditioning coach may prescribe moderate volume power-based training 24 to 48 hours prior to a sparring session to potentiate striking speed and power. In contrast, a high-volume maximal strength session 24 to 48 hours prior to sparring may result in high levels of neuromuscular fatigue, muscle soreness and delays in reaction time for that session. This may cause a reduction in training quality, hamper technical MMA skills being developed and decrease confidence in fighters—particularly in relation to sparring sessions.

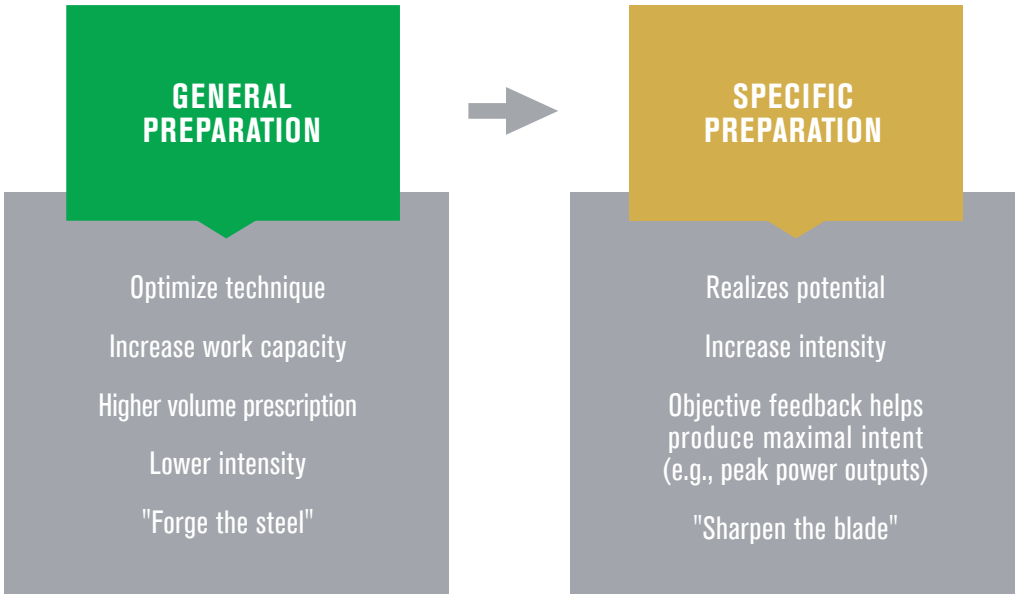
FIGURE 49.1

THE FIGHT PERIODIZATION CONTINUUM: SPECIFIC PREPARATION PHASE FOCUS



FIGURE 49.2

GENERAL THEMES AND DESIRED OUTCOMES OF SPECIFIC PREPARATION

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PART 2

SECTION 50

SECTION 50: SPECIFIC PREPARATION: STRENGTH AND POWER DEVELOPMENT

By Gavin Pratt

As high rates of muscle activation and relaxation are often seen in elite combat sport athletes, force transfer, movement capacity, power development and inter-muscular coordination are just some of the strength and power qualities an MMA athlete will want to improve during specific preparation. As previously mentioned in Section 49, this will generally mean there is a shift towards more dynamic, ballistic and velocity-based training (e.g., strength-power or power-speed) in specific preparation compared to general preparation. For instance, a fighter training a trap bar deadlift and barbell bench press for maximal strength in general preparation may progress to a banded trap bar deadlift and landmine press for dynamic strength in specific preparation. Focus during specific preparation also needs to be relevant to the sport of MMA and aligned with the fighter's assessment diagnostics.

Therefore, progressing strength and power training in specific preparation requires the following questions to be answered:

- Does the training continue to produce the appropriate strength and power adaptations for improved sports performance?
- Does the training continue to produce the appropriate strength and power adaptations for the fighter based on his or her strengths and weaknesses, relative to his or her weight class?
- Is exercise prescription progressing from a capacity focus toward an intensity focus?

Once these questions have been answered, the next step for coaches is to identify the best loading parameters and exercises to achieve these desired adaptations. For example, a fighter with a high force deficit would predominately use maximal strength and strength-power prescriptions in specific preparation. Meanwhile, a fighter with a velocity deficit would require a greater focus toward speed and power-speed prescriptions. Table 50.1 outlines a number of training methods, loading parameters and exercises (and their specific force vectors) that can be used during specific preparation, particularly to develop ballistic (strength-power or power-speed) improvements in fighters.

COACHES TALK

"The phrase 'sports-specific' should relate to the physiological adaptation being sought, rather than the mimicking of a specific technical movement within strength and power training."

Once the training methods, exercises and loading parameters for the fighter have been decided, any prescription then needs to be tailored to fit the overall strength and power training structure. As mentioned in general preparation, coaches are recommended to use a strength and power template that that works for their conditions and environment. Examples of a strength and power training template for specific preparation is given in Figures 50.2 and 50.3. This template highlights how exercises can be prescribed into the training plan appropriately based on a fighter's strength and power priorities (e.g., low force deficiency) and progressed across general preparation into specific preparation.

TABLE 50.1

EXAMPLES OF STRENGTH-POWER AND POWER-SPEED METHODS DURING SPECIFIC PREPARATION

METHOD	EXERCISE	STEP / REPS	LOAD	REST	FORCE VECTOR
Pulse/Oscillatory Training	Banded KB Deadlifts (Dimmels)	2-5 x 2-3 Clusters of 3-6 reps	30-60%1RM	120s	VERTICAL
Pulse/Oscillatory Training	Banded Half-Kneeling Chop	2-4 sets x 5-10 reps per set 2-5 Pulses per rep	Band only	60-90s	HORIZONTAL
Olympic Lift Derivatives	Clean High Pull	3-6 x 1-5	As heavy as possible for peak velocity > 2m/s	120-180s	VERTICAL
Olympic Lift Derivatives	BB Hang Jump Shrug	3-6 x 3-6	As heavy as possible for peak velocity > 2m/s	120-180s	VERTICAL
Overspeed	Band Assisted Countermovement Jump	2-5 x 3-5	BW	60-90s	VERTICAL
Overspeed	Band Assisted Plyometric Push Up	2-5 x 3-10	BW	60-90s	HORIZONTAL
Accommodating Resistance	Band Trap Bar Deadlift	2-5 x 3-7	60-75% 1RM	90-120s	VERTICAL
Accommodating Resistance	Banded Touch and Go Bench Press	2-5 x 3-7	40-60% 1RM	90-120s	HORIZONTAL
Eccentric Overload	Accentuated Eccentric Box Jumps	2-4 x 3-5	40-60% BW	60-120s	VERTICAL
Eccentric Overload	Accentuated Eccentric Bench Press	2-4 x 3-5	100-120% 1RM	120-180s	HORIZONTAL


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PROWLER 2

FIGURE 50.2

EXAMPLE OF UPPER BODY SPECIFIC PREPARATION PROGRAM STRUCTURE BASED ON FIGHTER WITH A LOW VELOCITY DEFICIENCY

PRIMARY SPEED (PUSH)	Plyometric Push Up Sled Press MB Throw Variations
SECONDARY SPEED-POWER (PULL)	Sled Row Heavy MB Caber Toss
ACCESSORY POWER (PUSH)	Landmine Single Arm Landmine Punch (Band Resisted) <or> BB Split Jerk (>1.3m/s mean velocity)
ACCESSORY POWER (PULL)	BB Power Clean from Hang (Mean Velocity >1.8m/s) <or> BB Prone Row (HVPT @ ~1.0 m/s)
SUPPLEMENTAL	Neck: Band Resisted Side Step (Dynamic) Trunk: Half Kneeling Band Chop (Oscillatory/Pulse) Wrist/Grip: DB Prontate to Supinate Rotations + Fat Gripz

FIGURE 50.3

EXAMPLE OF UPPER BODY SPECIFIC PREPARATION PROGRAM STRUCTURE BASED ON FIGHTER WITH A LOW FORCE DEFICIENCY

PRIMARY MAX FORCE (PUSH)	BB Incline Bench Press (Wave Loading >85% 1RM) BB Bench Press + Chains (Chains= 10-20% Total Load)
SECONDARY STRENGTH-SPEED (PULL)	Loaded Pull Up (70-80% 1RM) BB Prone Row (Clusters, 70-80% 1RM, Mean Velocity 0.5-0.75 m/s)
ACCESSORY STRENGTH-SPEED (PUSH)	Landmine Single Arm Press (>75% 1RM) <or> BB Push Press (Mean Velocity 0.5-0.75m/s)
ACCESSORY POWER (PULL)	BB Snatch High Pull from Rack (VBT 1.8 m/s) <or> BB Prone Speed Pulls (HVPT, VBT 0.75-1.0m/s Mean Velocity)
SUPPLEMENTAL	Neck: Protraction-Retraction Trunk: (Anti-Rotation) Pallof Press Wrist/Grip: BB Wrist Roll Up


Karate Hottie



PART 2
SECTION 51

SECTION 51: SPECIFIC PREPARATION: ENERGY SYSTEM DEVELOPMENT

By Kyle Larimer

Specific preparation is the time when the energy-system adaptations from general preparation should be built upon with a comprehensive focus on MMA. Compared to the work-to-rest ratios and blood lactate variables reported in Section 33 for individual combat sports, MMA has a wide range of outputs as no two fights are the same. There are various combinations of combat techniques and energy-system demands. For instance, the work-to-rest ratios of MMA have been reported to range from 1:1 to 1:4 with lactate production levels of 9.25 to 19.7 mmol/L. As such, energy system programming should now focus on strategies that most effectively translate to sport (e.g., resemble the above work-to-rest ratios and lactate levels) as well as the needs of the individual fighter.

In regard to the individual fighter's needs (and in addition to diagnostics from energy system assessments), gender, weight class and fighting style will also affect energy-system training in specific preparation. As discussed in Section 1, competition characteristics such as average fight time and finishing style vary based on the gender of an athlete and his or her weight class. A male heavyweight who competes in a division with a 49.5 percent knockout rate may have different energy-system development needs than a female strawweight who competes in a division where knockouts only account for 9.4 percent of fight results. Additionally, an athlete's predominant fighting style will have a large influence on energy-system training. As noted previously, different fighting styles have different energy demands. Therefore striking-dominant and grappling-dominant fighting styles may require varied energy-system approaches.

PRACTICAL APPLICATION AND IMPLEMENTATION

When implementing energy-system training in practice, it is important for coaches to consider that specific preparation is normally a period in which technical training will likely increase in volume and intensity compared to general preparation. Also, any energy-system work that produces high levels of fatigue (whether acute or delayed) needs additional thought as to when to implement. As mentioned in other sections, this means energy-system training must be structured to minimize any negative influence on technical training performance. Alongside this, there should be practical consideration given to what energy-system work a fighter is doing in technical training, and coaches should then attempt to compliment that work—not repeat it. For example, if an athlete is participating in grappling rounds with high anaerobic glycolytic demands during technical training, the strength and conditioning coach may decide to target alactic work in non-technical training. All these variables should then steer the practical implementation of energy-system training during specific preparation.

COACHES TALK

Although MMA competition involves five-minute rounds with a one-minute rest, a fighter's energy-system training should not always be in multiple bouts of five minutes or based off a 5:1 work:rest ratio. This approach may improve some capacities but will miss others, especially the high intensity ones. Energy-systems improvements require targeted training prescriptions and exclusive 5:1 training will limit the impact of a program.

TABLE 51.1

DIFFERENT INTERVAL-BASED ENERGY SYSTEM TRAINING PRESCRIPTIONS APPROPRIATE FOR FIGHTERS IN SPECIFIC PREPARATION

	HIIT - LONG INTERVALS	HIIT - SHORT INTERVALS	REPEATED SPRINT TRAINING	SPRINT INTERVAL TRAINING	FIGHT-BASED TRAINING
WORK	90 sec - 5 min	10 - 60 sec	5-20 second	10-30 sec	Implementation of any of the first four interval structures using MMA techniques and scenarios
REST	1 - 4 minutes	10 sec - 2 min	10 - 30 seconds	60 - 300 seconds	
INTENSITY	Moderate-High (80% to 95% max HR)	High (80% to 100% max HR)	Maximal Intensity	Maximal Intensity	
VOLUME	1 - 2 sets, 4 - 10 reps	1 - 4 sets, 4 - 20 reps	1 - 4 sets, 8 - 20 reps	1 - 4 sets, 3 - 8 reps	
WORK: REST RATIO	1:1 - 5:1	1:1 - 1:4	1:2 - 2:1	1:6 - 1:20	



Further and related to the need to make energy-system development more specific to the sport of MMA, there should be an increased focus on the muscle groups and functions (i.e., peripheral adaptations) used in fights during energy-system training in specific preparation. Circuits containing sleds, medicine balls, versa climbers, battle ropes and other items can be great choices to achieve more peripheral adaptations in the desired muscle groups for a fighter. This increased peripheral focus should be complimented with strategic work:rest ratio prescriptions depending on which energy system the fighter needs to develop in a session. Table 51.1 provides different interval-based energy system training prescriptions that can be used for fighters in specific preparation. These prescriptions can be used not just by strength and conditioning coaches in non-technical training but also in conjunction with MMA coaches in technical training.





PART 2
SECTION 52

SECTION 52: PERFORMANCE BREATHING

By Gavin Pratt and Tera Giroux

Propriety intellectual property for this chapter has been contributed by Brian McKenzie, Bryan Diaz, and Rob Wilson from Shift©.

Breathing is not only essential for life, but it can also be a mechanism used to improve the performance and recovery of a fighter. By improving breathing, it is possible to increase blood flow, elevate oxygen utilization in working muscles and improve mental state. Another key function of breathing is that it can modify the autonomic nervous system (ANS). The ANS manages stress within the body and consists of two components: i) the sympathetic ("fight, flight or freeze") system and ii) the parasympathetic ("rest and digest") system. The use of breathing to control the autonomic nervous system becomes highly relevant in MMA, especially considering the extremely high sympathetic nature of fighting. An increased sympathetic state above a fighter's optimal zone impacts emotion-attention interaction (i.e., a greater emotional response decreases the ability to focus attention), which can negatively influence motor task performance and processing of instructions. Having the ability to use breathing to modify the sympathetic-parasympathetic balance and decrease heart rate rapidly during and between rounds potentially enables fighters to have improved motor task performance, to have better recovery between rounds, to avoid "adrenaline dumps" and also to process important technical and tactical cues from their coach.

Poor breathing habits are easily formed with the introduction of life stressors, bad posture and inadequate breathing mechanics. With inadequate breathing mechanics, the neck and shoulder muscles are dominant, whereas proper breathing mechanics should be initiated by the diaphragm and predominately controlled by the nose—particularly at low- to moderate-intensity levels. These inadequate breathing mechanics have been shown to increase hyperventilation (over-breathing) which can negatively impact a fighter's performance. Hyperventilation causes a large decrease in blood carbon dioxide, which in turn, increases blood alkalinity and vasoconstriction. Not only does the decrease in blood carbon dioxide impair circulation to the body and brain, it also decreases the ability of haemoglobin to release oxygen to the working muscles. This is known as the Bohr Effect.

To begin performance breathing training with a fighter, it is recommended to have a baseline to understand if any future training is successful or not. Breathing capabilities can be tested with a number of simple assessments (Figure 52.1) including a maximal breathlessness test, body-oxygen level test (BOLT) or a resonance frequency score. The maximal breathlessness test and BOLT come from the work of Patrick McKeown, who is one of the world's leading authorities on breathing methods.

Once a baseline has been established, breath work can be introduced in training through the step-by-step progressions detailed in Figure 52.2. For example, the athlete may begin learning the correct mechanics of breathing (via the diaphragm) in a stationary land-based drill using individual resonance frequency. This can then be progressed over time by introducing a water-based (modality) swimming exercise (dynamic) in which the athlete would count the number of freestyle strokes he or she can complete during a maximal breath hold (control). As the fighter progresses his or her technique, sports-specific drills can be introduced that require high-intensity dynamic movement aimed at enhancing performance, such as breath holds during bag/pad work for increased carbon dioxide tolerance or nasal-only breathing during grappling sessions to develop efficient breathing mechanics at low intensity. Identifying the different components of a fighter's training can be a simple way to integrate breath work into the daily schedule, as each facet of training contains different opportunities to improve breathing function and challenge the autonomic nervous system. Examples of how specific breathing interventions can be prescribed within different components of MMA training are explained in Figure 52.2.

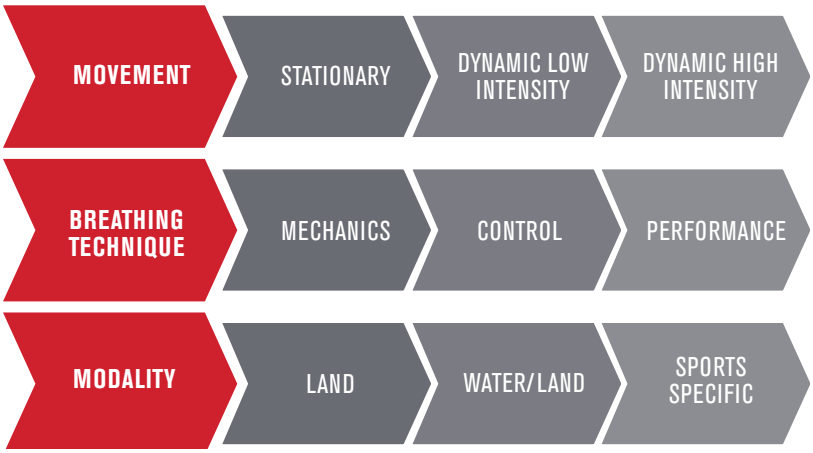
COACHES TALK

Breathing techniques for performance can be considered a "bottom up" approach. A major benefit to this approach, when compared to equally valuable "top down" methods, such as neurofeedback and guided meditation, is that "bottom up" methods can be brought into the Octagon by the fighter.

FIGURE 52.1
EXAMPLES OF BASELINE BREATHING TESTS

TEST	DESCRIPTION
BODY OXYGEN LEVEL TEST (BOLT)	In a relaxed, seated position take a small inhalation through your nose followed by a small exhalation through nose and then hold breath. The BOLT score is the time in seconds until you feel first signs of air hunger (usually an involuntary movement such as an abdomen "kick," excessive blinking or swallowing). Normal, calm nasal breathing should resume at test completion, not large inhalations. This is not a maximal breath-hold test. It is testing when the body's first desire to breathe is.
MAXIMAL BREATHLESSNESS TEST (MBT)	Take a small inhalation through your nose followed by a small exhalation through nose and then hold breath. If on land, pinch your nose for a validity measure (no cheating)! Count the total steps (land) or strokes (water) you can complete on a maximum effort breath hold. You must breathe in through your nose at the end of the test, not mouth. Athletes should be aiming for 80 to 100 steps walking (land). NOTE: Any water training MUST be completed alongside a training partner.
RESONANCE FREQUENCY SCORE (RF)	Testing heart rate variability (HRV) at different breathing rates can indicate an individual's optimal RF, when oscillations in heart and breathing rate synchronize. Heart rate variability biofeedback can then be utilized to interactively teach the fighter to alter his or her physiological responses. The optimal resonance frequency is commonly within 5.5 to 8 breaths per minute (~4s inhale/exhale), but individual RF is important to distinguish to ensure the most effective intervention.

FIGURE 52.2
CONTINUUM OF PERFORMANCE BREATHING



WARM UP

If an athlete arrives to training in a sluggish high-parasympathetic state (e.g., over-slept, illness), amplifying the sympathetic nervous system before training can be a great way to get the fighter ready for training. In this case, super-ventilation as detailed in Table 52.1 could be used. Alternatively, the fighter may be coming to training in an agitated high-sympathetic state (e.g., traffic jam, argument with loved one), so increasing their parasympathetic tone may be appropriate. For these occasions, utilizing a box breathing pattern as described in Table 52.1 could be a possible intervention in the warm-up.

DURING TRAINING

There are various breathing techniques that can be used during training. It is recommended that athletes generally learn and master these techniques in alignment with the continuum of breathing performance (Figure 52.1). These techniques include:

- Breathing "gears"
- Breath-hold work with high and low lung volumes
- The Valsalva Maneuver
- Heart-rate recovery work
- Wearing a resisted breathing mask

Using breathing "gears" is a concept that applies different combinations of nose and mouth breathing sequences to regulate and shift training intensity and recovery periods. These can be thought of in a similar sense to that of a manual car and are described in Figure 52.2. Depending on your desired training intensity, the gears can be used by fighters to ensure the correct intensity is performed in training. The use of efficient nasal breathing mechanics can be used to manipulate recovery. For example, following one short, maximal effort sprint for 30 seconds at gear three breathing, breathing gears two-three could be prescribed for the 60-second recovery with the aim of decreasing heart rate by 20 percent in that timeframe. As the set progresses towards the fighters' lactate threshold, breathing gears four-five will be required during the set; however nasal breathing for recovery is still recommended if possible. This is because there is less expiration of carbon dioxide, and nasal breathing provides the lungs with nitric oxide upon inhalation, widening blood vessels. Both of these mechanisms increase the ability to oxygenate working muscles and organs.

Breathing techniques can also be used with both high (HLV) and low lung volumes (LLV). For HLV drills, an athlete will inhale fully and hold his or her breath for a set or maximum time. For LLV drills, an athlete will inhale, lightly exhale and then hold for a set or maximum time. LLV drills typically exposes the athlete to increased carbon dioxide levels earlier in the breath hold. Prescription of these types of drills will potentially aid in increasing the blood's oxygen carrying capacity, red blood cell count and carbon dioxide tolerance. However, these drills are not recommended for individuals who have a BOLT score lower than 20 seconds, and ideally, most athletes should aim for a BOLT score greater than 40 seconds.

The Valsalva Maneuver is another breathing exercise that can be used to help develop a fighter's diaphragmatic control. This maneuver will be more likely to be applied in strength and power sessions when there are axial loads (e.g., a barbell on the fighter's back). Using this maneuver will act as a core stabiliser, similar to a weightlifting belt, and increases the safety of the athlete when lifting heavy loads.

FIGURE 52.3
PERFORMANCE BREATHING "GEARS" USING DIFFERENT COMBINATIONS OF NOSE AND MOUTH BREATHING

GEAR	MECHANICS	ENERGY SYSTEM	VENTILATORY THRESHOLD	INTENSITY (RPE)
GEAR 1	NASAL IN/OUT	AEROBIC	<VT1	LIGHT
GEAR 2	NASAL IN/OUT	AEROBIC	VT1+5-10%	MODERATE
GEAR 3	NASAL IN/OUT	ANAEROBIC-AEROBIC	VT2	MODERATE-HEAVY
GEAR 4	NASAL IN/MOUTH OUT	ANAEROBIC	VT2+5-10%	HEAVY
GEAR 5	MOUTH IN/OUT	ANAEROBIC	NEAR MAX	VERY HEAVY

The information provided in figure 52.3, and the paradigm of breathing "gears", is propriety to Brian McKenzie, Bryan Diaz, and Rob Wilson from Shift©. The UFC Performance Institute acknowledges the methods presented here are based on their work. Please visit www.shiftadapt.com for more information about their methods and expertise.

TABLE 52.1
DIFFERENT BREATHING METHODS THAT ARE APPROPRIATE FOR A FIGHTER'S WARM UP

DRILLS	AUTONOMIC SYSTEM FOCUS	PRESCRIPTION	PROGRESSION
SUPER-VENTILATION	SYMPATHETIC	NASAL, 1:1s, 2 X 30S	STATIONARY, MECHANICS, LAND-BASED
BOX BREATHING (INHALE, HOLD, EXHALE, HOLD)	PARASYMPATHETIC	NASAL, 4:4:4:4s FOR 2-3MIN	STATIONARY, MECHANICS, LAND-BASED

TABLE 52.2
DIFFERENT BREATHING METHODS THAT ARE APPROPRIATE FOR A FIGHTER'S COOL DOWN

DRILLS	AUTONOMIC SYSTEM FOCUS	PRESCRIPTION	PROGRESSION
BREATH RESONANCE FREQUENCY	PARASYMPATHETIC	INDIVIDUALIZED BASED ON HEART RATE VARIABILITY (~5.5 TO 8 BREATHS/MINUTE)	STATIONARY, CONTROL, LAND-BASED
TRIANGLE BREATH (INHALE, HOLD, EXHALE)	PARASYMPATHETIC	3:3:3s FOR 3-5 MINUTES	STATIONARY, MECHANICS, LAND-BASED

TABLE 52.3
EXAMPLES OF TWO WATER-BASED BREATHING DRILLS

DRILLS	AUTONOMIC SYSTEM FOCUS	PRESCRIPTION	PROGRESSION
CO_2 TOLERANCE	SYMPATHETIC	LOW LUNG VOLUME UNDERWATER BREATH HOLD FOR DISTANCE	HIGH INTENSITY, PERFORMANCE, WATER-BASED
FACE-ONLY COLD WATER IMMERSION (~9-12OC)	SYMPATHETIC	LOW LUNG VOLUME BREATH HOLD 5-10 SETS WITH 1-2 MIN RECOVERY	STATIONARY, CONTROL, WATER-BASED

The information provided in tables 52.1, 52.2, and 52.3 is an interpretation of the proprietary intellectual property of Brian McKenzie, Bryan Diaz, and Rob Wilson from Shift©.

Heart rate recovery is the difference between the peak heart rate reached during exercise and the subsequent drop off at specific time points. The most significant time point for MMA-related heart rate recovery is 60 seconds, as it is the duration between rounds in competition. As recovery rate often correlates to high aerobic capacity and repeat high-power output within elite athletes, utilizing breathing techniques to decrease the recovery time will aid fighters in maintaining high frequency striking and repeat takedown attempts. Recovery breathing driven through the nose via diaphragmatic mechanics allows the lower lobes of the lungs to receive oxygen (where a greater amount of blood vessels exist) allowing for increased delivery of oxygen to the body. Often the instruction of "take a big breath" will see chest/shoulder driven breathing mechanics via an open mouth. However, this "big breath" results in limiting oxygen delivery to the working muscles and an increased breathing rate due to a greater expiration of carbon dioxide. Calm, slow and relaxed breathing through the nose will often decrease stress levels and increase the energy response. However, training this mechanism prior to competition is essential to be able to optimize during competition.


UFC
Reebok
UFC

Resisted breathing masks are commonly seen as a social media gimmick, but they may be a valuable tool for certain fighters. Predominately, a resisted breathing mask will collect carbon dioxide between face and mask, causing the body to adapt to higher levels of carbon dioxide than normal and make it harder for the inspiratory muscles to inhale the same amount of oxygen. Over time, increased carbon dioxide tolerance results in a decrease of hyperventilation and an improved breathing efficiency. This may enhance both work capacity (e.g., increased ventilatory thresholds) and recovery. Resisted training masks are also seen to be an effective tool for developing the strength and efficiency of the inspiratory muscles (such as the diaphragm). This reduces the amount of oxygen these inspiratory muscles require during exercise, creating a greater availability of oxygen for other working muscles. Although most applicable during conditioning sessions, use of a resisted training mask during strength and power training has shown no negative response of volume output across sets in bench press and back squat exercises. However, peak velocities during these exercises have exhibited a decrease across time, meaning if the velocity component of a fighter's power training program is deemed a priority, a resisted training mask may not be an effective tool.

Once mastered in non-technical training, all these techniques can then be incorporated in technical training. Drilling and sparring also create an opportunity to practice the pre-aforementioned methods under different intensities in technical training, such as consciously working on heart rate recovery between rounds.

COOL DOWN

Often athletes will finish a session without time to unwind or de-stress and remain in a sympathetic state for hours after training. This can affect sleeping patterns (e.g., delayed sleep onset) especially if a fighter's training session is in the evening. For fighters who have these issues, there needs to be time allocated to getting a fighter into a parasympathetic state after a training session. A fighter's individual breath resonance frequency and triangle breathing are methods that can both be used to help shift fighters into a more restful state after training. These are detailed in Table 52.2. Smartphone or tablet applications can also be utilized to guide the specific timing of breathing.

USING WATER TO AUGMENT PERFORMANCE BREATHING

Water-based training can be a useful tool to help augment performance breathing work. It is essential whenever doing water-based drills that the fighter has a partner to work with and that safety signs are determined prior to any drills being completed. Water-based drills have been shown to have an oxygen-conserving effect during land and water-based exercise predominately due to a decline in cardiac output. Breathing drills in water can also extend a fighter's comfort zone, even if the individual is extremely comfortable in the water, as an increase in sympathetic response when being submerged adds to the demands of controlling breath function. To increase this sympathetic reaction even further, another progression is to complete these breath holds completely submerged, semi-submerged (up to shoulders) or even just face-only in cold water at approximately 10 to 12 degrees Celsius. Examples of two water-based performance drills are detailed in Table 52.3.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PART 2

SECTION 53

SECTION 53: STRESS RECOVERY AND RELAXATION

By Micah Schurnstein, Heather Thanepohn

Skills to increase resilience and decrease stress during a fight cycle.



Self-care and relaxation techniques are effective at increasing performance and providing support. Consistent use of these skills provides support in multiple areas of a fighter's life and decreases the opportunity for stress and emotions to pull fighters away from performance goals.



BODY SCAN

A body scan is a mindful practice that increases a fighter's ability to be aware of sensations in the body, while decreasing stress, anxiety and muscle tension. During a body scan, a fighter can increase his or her ability to be present and notice bodily sensations. This can be completed by sitting or lying down in a comfortable position and then bringing awareness to individual body parts. An effective method is to start with the toes and feet, while working slowly up through your body, joint-by-joint, up to the jaw and head. When thoughts wander, notice without judgement and bring attention back to the identified body part. A body scan is another supportive skill that can be used as part of a sleep-hygiene routine.



MEDITATION

Meditation supports focus and present moment awareness, while also reducing stress and anxiety experienced by fighters. Meditation can improve mood, concentration and pain management which are important considering the high physical and emotional demands placed on them. One method of practicing meditation is to focus attention on breathing. It can be accomplished by finding a mentally calm place to settle and then by bringing focus to the breath. While breathing, scan the body, noticing what is present and allow the mind to be present with the breath. If your mind wanders, bring attention back to the breath. Meditation is another skill that can also be used to improve a fighter's sleep.



SENSORY AWARENESS

Sensory awareness is mental skill that increases a fighter's ability to bring awareness to the present moment. By paying attention to different senses, a fighter can decrease stress, anxiety and other challenging emotions associated with dwelling in the past or worrying about the future. Fighters who focus attention on what they can hear, smell, taste, feel and see are able to ground themselves in the present moment. When the mind wanders while practicing this skill, notice (without judgement) and bring attention back to the identified sense. Increased present awareness can be improved through consistently by using this skill for a few minutes each day.



PROGRESSIVE MUSCLE RELAXATION (PMR)

PMR supports muscle tension, stress, and anxiety relief and is especially appropriate after training. A fighter will identify and focus on a muscle group and tense the muscle as they breathe in, followed by relaxing the muscle as they breathe out. Inhalation and exhalation can last five to 10 seconds and fighters should bring attention to their muscles while breathing, noticing the different feeling between tension and relaxation. This process is repeated with all major muscle groups in the body. Through continued utilization of PMR, a fighter can decrease stress, anxiety and improve sleep.


PRO
COMBAT

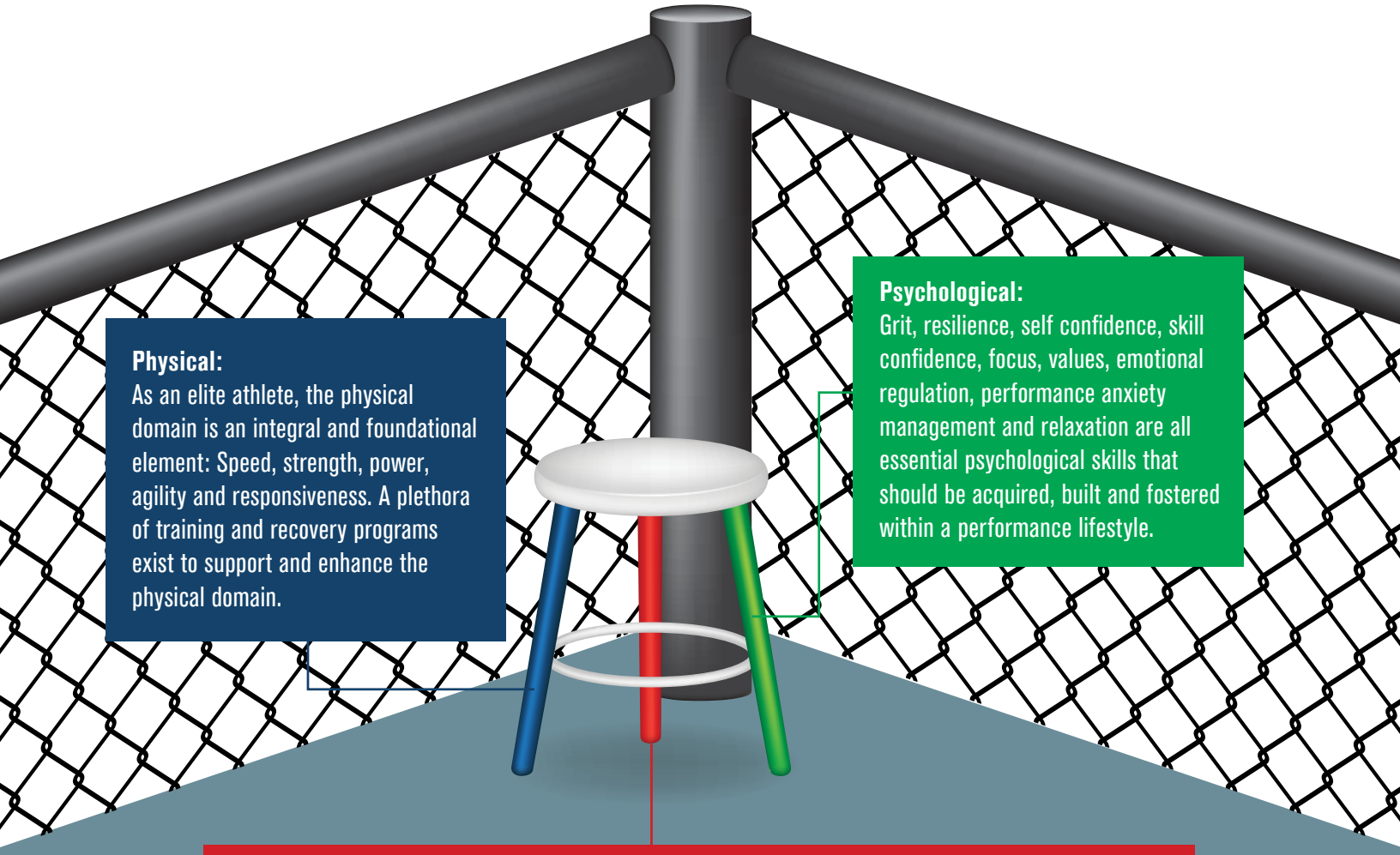


PART 2
SECTION 54

SECTION 54: PERFORMANCE LIFESTYLE

By Micah Schurnstein and Heather Thanepohn

Creating a performance lifestyle centers around fighters including activities that support physical, psychological and social/emotional growth. It is important to include activities from all three areas to support the highest level of performance and consistency through a fight cycle. Imagine a three-leg stool, with each one of these areas representing a leg on the stool. If one area is neglected, the stool becomes less sturdy and unable to perform or handle stress its highest level. When the stool is functioning at its optimal level with all three legs strongly supporting, it is able to better support performance and handle stress. Below is an example of what a performance lifestyle may look like for a fighter in a schedule that includes activities and practices that promote physical, psychological and social/emotional growth. By using methods to identify a fighter's values (See Section 7), incorporating a mental reset (See Section 25) and using skills to increase stress relief and relaxation (See Section 54), a fighter can begin creating his or her own performance lifestyle structure.



Physical:
As an elite athlete, the physical domain is an integral and foundational element: Speed, strength, power, agility and responsiveness. A plethora of training and recovery programs exist to support and enhance the physical domain.

Psychological:
Grit, resilience, self confidence, skill confidence, focus, values, emotional regulation, performance anxiety management and relaxation are all essential psychological skills that should be acquired, built and fostered within a performance lifestyle.

Social/Emotional:
According to Dr. Ian Jeffreys, "An emotionally healthy athlete has a great capacity for training and recovery. However, this aspect of fitness can be eroded rapidly and must be constantly monitored and developed." The active mind of an athlete has the capacity to generate thoughts and feelings that can have a positive or negative impact on performance. Improving social/emotional fitness requires capitalizing on and developing the emotional intelligence (EQ), self-awareness, social aptitude and control of the athlete.

TASK	TIME	AREA
Wake up	7:00 AM	
Mindfulness (e.g., stretching, meditation, body scan, progressive muscle relaxation (PMR))	7:30 AM	PSYCHOLOGICAL
Nutrition Plan / Hydration	8:00 AM	
Physical Therapy / Medical	9:00 AM	PHYSICAL
Strength & Conditioning	9:30 AM	PHYSICAL
Mindful Reset (e.g., sensory awareness, identify and move toward individual values)	11:00 AM	PSYCHOLOGICAL
Nutrition Plan / Hydration	11:30 AM	
Sparring / Technical Training	1:00 PM	PHYSICAL
Self-Care / Recovery (e.g., stretching, hot tub, ice, massage, yoga, breathing)	3:00 PM	PHYSICAL
Nutrition Plan / Hydration	3:30 PM	
Strategy / Coaching Review / Film / Visualization	4:00 PM	PSYCHOLOGICAL
Time for Individual Values (e.g., family, friendships)	5:00 PM	SOCIAL/EMOTIONAL
Nutrition Plan / Hydration	6:00 PM	
Personal Self-Care (e.g., reading, art, movie)	7:00 PM	SOCIAL/EMOTIONAL
Bed Routine / Mindfulness (e.g., meditation, body scan, PMR)	9:00 PM	PSYCHOLOGICAL
Sleep	10:00 PM	

PART 3

FIGHT-CAMP



SECTION 55: FIGHT-CAMP PHILOSOPHY

By Joseph Coyne, Forrest Griffin and Dean Amasinger

The primary goal of fight-camp is to holistically prepare the athlete for competition physically, mentally and spiritually. To do this, we advocate an increased emphasis on a fighter's strengths in technical training while continuing to minimize any non-technical weaknesses and risk of injury. The increased emphasis on the athlete's strengths in technical training will benefit the athlete in a number of ways. First, and most importantly, it will help to reinforce and potentially improve any competitive advantage that an athlete has in the weight division. Second, there will be positive benefits to the athlete's mindset—especially in confidence, as reinforcing technical skills in which he or she excels will serve as reassurance of expertise and capabilities. To go with this strength's emphasis and the development of an optimal mindset, it is also recommended the fight-camp includes an increased frequency of positive coach reinforcement and a conscious framing strategy for any feedback given to the athlete. As fight-camp can be characterized by a higher injury risk closer to the fight due to higher training intensities, increased sparring loads, an increased calorie deficit and competition anxiety, having an emphasis on what a fighter is good at may mean injuries are less likely to occur.

"I'VE SEEN MY FAIR SHARE OF HIGH-LEVEL CAMPS. A SYSTEMATIC AND ORGANIZED STRUCTURE HAS BEEN THE BIGGEST FACTOR IN WHETHER THEY ARE SUCCESSFUL OR NOT."

FORREST GRIFFIN, UFC HALL OF FAMER

For non-technical training, the emphasis of minimizing weaknesses would normally remain the same as in off-camp. There are a number of reasons for this. Generally, we recommend devoting less time to non-technical training in fight-camp compared to off-camp. As such, the priority is given to ensuring that the athlete cannot be exploited by his or her opponent in any non-technical areas—again, bearing in mind the upcoming opponent. A lower amount of non-technical training time also means a weakness emphasis may not impact an athlete's mindset to the same degree as technical training. However, if there are no non-technical weaknesses compared to the upcoming opponent, the fight-camp non-technical strategy could shift to emphasise physical strengths. The non-technical focus in fight-camp may also need to shift if an athlete is "psychologically attached" to a certain exercise (e.g., when an athlete feels punching power is directly related to bench press gains). Regardless of choice of non-technical emphasis, it is recommended that coaches, again, consider the frequency of positive reinforcement and the framing of feedback to the fighter during fight-camp. Examples of how to emphasize technical strengths and non-technical weaknesses for two different fighters within the constraints of a six-week fight-camp are displayed in Table 55.1.

Prior to beginning a fight-camp, we suggest a review of any progress made during the off-camp phase (e.g., How much progress has been made in technical or non-technical areas? Does time still need to be devoted to this technical area bearing in mind the opponent?") to help prioritize the needs of fight-camp. The fight-camp needs analysis should also consider previous fights (e.g., what does the fighter do well in competition?) and technical competency (e.g., what is the fighter best at in training?) Finally, consideration should also be given to an athlete's technical strengths and whether they align with what it takes to win in MMA competition (See Section 1), while considering the upcoming opponent and how technically weak he or she is relative to an opponent's strengths. These factors will once again impact the degree to which a technical strength focus in fight-camp is appropriate.

Last, fight-camp should entail a shift to a much more competitive mindset and attitude for the athlete and support staff as compared to off-camp, where the coaching philosophy was based around learning and exploration. In fight-camp, this philosophy should shift to the fighter winning every second of every round of every competitive training scenario (e.g., sparring, live go's). Coaches can amplify this approach by increasing the emphasis and frequency of competitive situations in technical training, while simultaneously refining or reducing the desired techniques to be focused on in the fight. Ideally, technical training should no longer separate the individual martial arts in training, but fully integrate MMA techniques and concepts within single sessions. Although creativity can still be promoted, this should be in a structured manner that promotes fight IQ and a tactical awareness of an opponent's tendencies, strengths and weaknesses, as well as when to use particular higher or lower risk techniques in competition. This shift along the technical tactical spectrum (see Figure 18.3) is a key difference in coaching strategy between off camp and fight camp. Coaches should also be conscious of the fact that there will be a stage in late fight-camp (i.e., the last two to three weeks prior to competition) where both the technical and non-technical training should shift to be primarily focused on i) peaking for competition and ii) the weight cut. All these considerations are then merged and balanced against one another in order to impact the design and planning of training for the fight-camp.

ALL DECISIONS IN FIGHT-CAMP SHOULD BE VIEWED THROUGH THE LENS OF WHETHER IT WILL INCREASE CONFIDENCE AND COMPETITION READINESS.

FIGURE 55.1

EMPHASIZING TECHNICAL STRENGTHS AND NON-TECHNICAL WEAKNESSES FOR TWO DIFFERENT FIGHTERS DURING A SIX-WEEK FIGHT-CAMP

TT = TECHNICAL TRAINING **NTT** = NON-TECHNICAL TRAINING (1) = PRIMARY FOCUS (2) = SECONDARY FOCUS

	FIGHTER I (STRONG GRAPPLER, POOR ALACTIC POWER)		FIGHTER II (STRONG STRIKER, POOR MAXIMAL STRENGTH)	
WEEK	TT FOCUS	NTT FOCUS	TT FOCUS	NTT FOCUS
WEEK 1	Grappling (2) Striking (1)	Alactic (2) Lactic TT Aerobic TT	Grappling (1) Striking (2)	Strength (2) Strength-Speed (1) Speed-Strength TT Speed TT
WEEK 2	Grappling (2) Striking (1)	Alactic (2) Lactic TT Aerobic TT	Grappling (1) Striking (2)	Strength (2) Strength-Speed (1) Speed-Strength TT Speed TT
WEEK 3	Grappling (2) Striking (1)	Alactic (1) Lactic TT Aerobic TT	Grappling (1) Striking (2)	Strength (2) Strength-Speed (1) Speed-Strength TT Speed TT
WEEK 4	Grappling (2) Striking (1)	Alactic (1) Lactic TT Aerobic TT	Grappling (1) Striking (2)	Strength (1) Strength-Speed (1) Speed-Strength TT Speed TT
WEEK 5	Grappling (1) Striking (1)	Alactic TT Lactic TT Aerobic TT	Grappling (1) Striking (1)	Strength TT Strength-Speed (1) Speed-Strength (1) Speed TT
WEEK 6	Fight-week, weight cut and competition			

(Note: Not a complete technical and non-technical training representation)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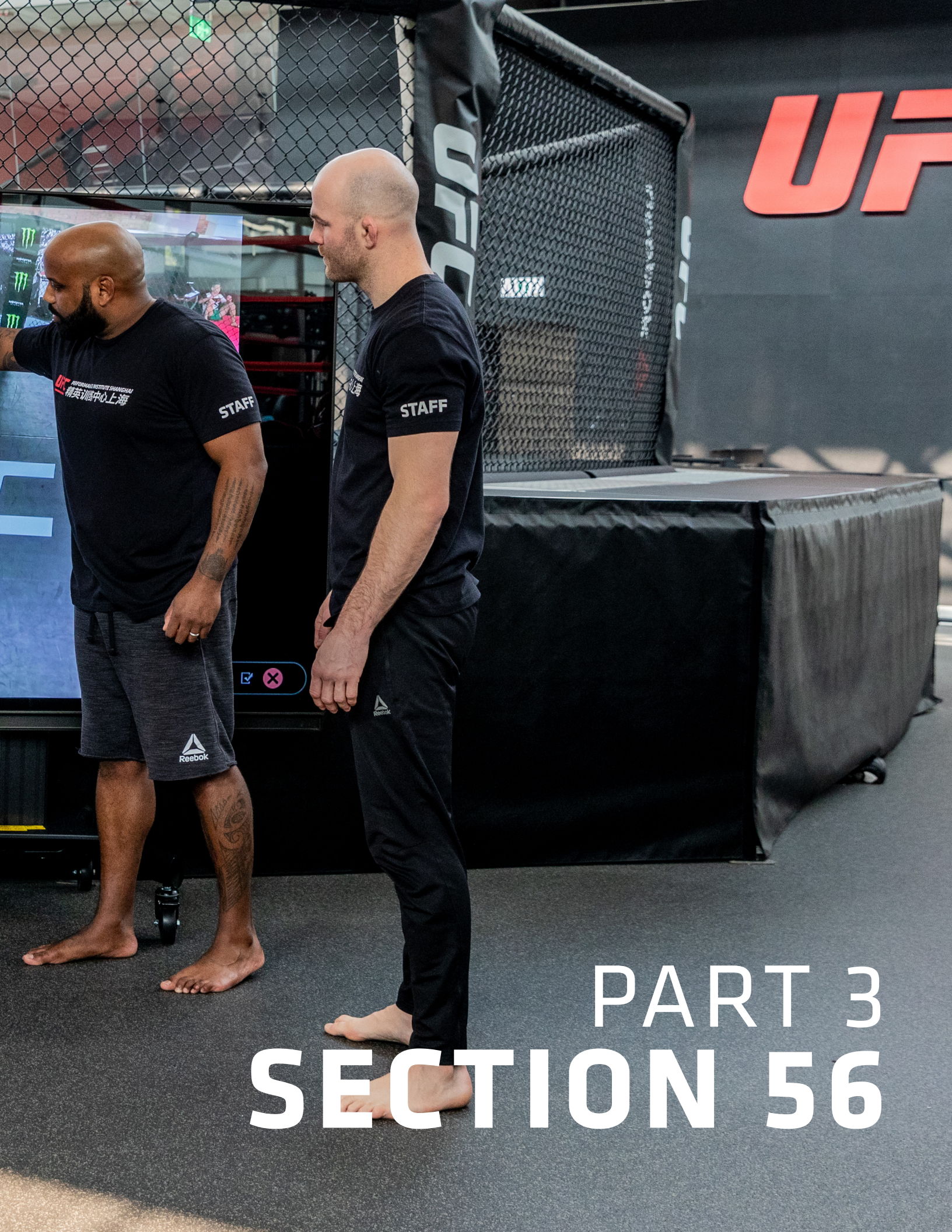


PART 3
SECTION 56

SECTION 56: FIGHTER AND OPPONENT EVALUATIONS

By Forrest Griffin and Richy Walsh

Comparatively evaluating a fighter and his or her opponents' tendencies, strengths and weaknesses can help define the tactics that will lead to the clearest "path of victory" in an upcoming bout. This evaluation can be achieved through a combination of subjective (e.g., coach's eye) and objective (e.g., fight statistics) analysis and will help develop an appropriate game-plan for a fighter. The game plan should maximize a fighter's positive technical, physiological and psychological attributes while negating the opponent's strengths and exploiting weaknesses as much as possible. Figure 56.1 provides an outline of how coaches and fighters may develop a game plan for an upcoming bout.

Game planning can begin as soon as a fight is agreed to and the opponent and fight date are known. This will allow a coach to prioritize drills and tailor practices to the skills that the fighter wants to highlight and perceives to be needed in the upcoming bout at the start of fight-camp. A game plan can be developed independent of an opponent (i.e., highlights a fighter's strengths they would try to implement regardless of opponent). More advanced or experienced fighters will have more fight footage available, whereas inexperienced fighters will typically have less—or the footage can be more difficult to find. This works well with the concept that less experienced fighters will work more on developing their skills and less on adapting to an upcoming opponent (see Table 18.3). If there is adequate fight footage, formulating the game plan can be achieved by the athlete and his or her technical support team (ideally, the coaches or fellow fighters that will be cornering the upcoming fight) watching the opponent's most recent fights. There are no set number of fights to watch, and an important concept is to weigh what an opponent is doing in more recent fights more heavily than older fights. Factors to consider when viewing an opponent's previous fights include length of time since last fight, any change of camp or coaches, amount of recent footage, level of competition and injury history (if public). The athlete and his or her technical support team may also complete this same process with the athlete's own most recent competitions. This may give an indication of what the opponent will perceive the fighter's strengths and weakness are and how the opponent may prepare tactically for the upcoming bout.

Two statistics that should be considered when deciding how much time to devote to the opponent-based aspect of a game plan are i) the length of time a fighter has before a bout to prepare, and ii) the likelihood that an opponent may change due to unforeseen events (e.g., injury, illness). In 2018, 62 percent of fights were signed outside of an eight-week period and of that amount, approximately 4 percent had an opponent change before the bout. The amount of fights signed outside of an eight-week period in 2019 was again 62 percent, however approximately 7 percent had an opponent change before the bout. Therefore, these statistics would indicate that there is value in preparing for a particular opponent as the opponent is not likely to change in the eight weeks prior to the fight. However, even if there is an opponent change, or the fight does not come to fruition, the drills and techniques developed for the game plan still have value as they have helped the fighter develop or improve in new areas that will provide value in the future.

FIGURE 56.1
FIGHTER AND OPPONENT EVALUATION

VIDEO ANALYSIS

1. SUBJECTIVE 'COACHES EYE'

Totally subjective look into opponent footage/athlete



- Coaches/fighters perspective on opponent's perceived strengths and weaknesses.

- Subjective measurement using judgment and experience. Comparing (most recent) fights of opponent to current fighter.

2. OBJECTIVE MARKING CRITERIA

Objectifying the video analysis; allowing coach(es)/team to assess opponent & fighter strengths and weaknesses

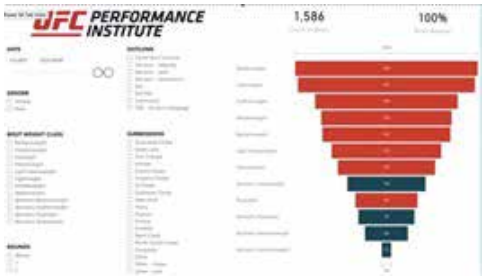


-Utilizing objective criteria (6 key area score sheet) to compare fighter and opponent.

-This highlights strengths and weaknesses in certain areas helping define a clearer path to victory and game plan.
Comparison of fighter and opponent tapes.

3. DATA SETS *(IF DATA IS AVAILABLE)*

If outliers appear between subjective & objective analysis



-Data can be used as a mechanism of validation particularly with UFC and high level competitions/Fights with sufficient data banks and fight stats.

- If lower level competition or no fight footage is available then disregard this step.

GAMEPLAN



In terms of how a game plan will influence training in fight-camp, the evaluation of the opponent should provide ranges, positions and techniques for striking and wrestling/grappling for which the fighter and technical support team feel they have an advantage or disadvantage. Drills to create, avoid or escape those ranges, positions or techniques should be used during fight-camp (e.g., if an opponent is very good at fence takedowns, a fighter might work on footwork drills to avoid being corralled or cut off and cornered against the cage). An opponent's tendencies can also be simulated by training partners (e.g., if the opponent often lands a specific striking combination in fights, a fighter can have training partners throw that combination in sparring sessions). Alongside ranges, positions, techniques and skill level, a fighter should also consider training partners for their similarity with the opponent's physical characteristics (e.g., height, reach and size) to help more realistically create the environment where the game plan will have to be implemented.

The amount of influence a game plan will have on the training in fight-camp will often depend on the developmental stage of the fighter. As a general guideline, the less technically developed a fighter is, the less influence the opponent-based aspect of a game-plan will have on training due to the need to continue developing an overall skill base. However, the opponent-based aspect of a game plan may have a greater influence on training for more technically developed fighters, as they may incorporate specific drills based on likely fight situations and how to make those desired fight situations come to fruition—all based on their opponent. The amount of time spent on the opponent-based aspect of a game plan in training is also dependent on the opponent's respective skill set, discipline and whether they are a specialist (e.g., kickboxer, wrestler) or generalist with well rounded skills in all areas but does not excel at any one (see Table 56.1).

Table 56.2 is meant to help a coach and/or fighter objectify and specify his or her thoughts around the strengths and weaknesses of an opponent in an attempt to find the easiest path to victory. These considerations merely serve as a framework and can be expanded to include any metrics the coach or fighter deem relevant to the upcoming fight.

TABLE 56.2

6 KEY AREAS OF OBJECTIVE ASSESSMENT: ATHLETE VS OPPONENT OBJECTIVE SCORING

KEY AREAS	DESCRIPTION OF CRITERIA
DISTANCE/STRIKING	▪ Offensive tendencies; Type of strike, combinations ▪ Defensive tendencies; head movement, etc. ▪ Strikes landed vs strikes absorbed (ratio of significant) ▪ Strikes attempted vs strikes landed ▪ KO/TKO v KO/TKO absorbed (method)
WRESTLING/CLINCH	▪ Offensive tendencies; set up's used for takedowns, types of takedowns ▪ Defensive tendencies; types of defense used ▪ Take downs vs times taken down ▪ Take down % attempts vs landed ▪ Time spent in clinch/fence control vs time spent being controlled
GROUND/GRAPPLING	▪ Offensive tendencies; strikes/submission attempts ▪ Defensive tendencies; positional preferences ▪ Time in control vs time controlled. ▪ Strikes landed vs strikes absorbed (TKO vs getting TKO'd) ▪ Submission attempts vs submissions (% & type) ▪ Submission vs times submitted (type and setup)
TRANSITIONS	▪ Tendencies; get-ups used,preferred direction, side, or passes, etc. ▪ Strikes used into takedowns and patterns (susceptibility to setups) ▪ Sweeps & reversals, number of times swept or submitted in scrambles ▪ Scramble tendencies; do they gain or lose position in scrambles
PHYSICAL	▪ Tendencies; does opponent get fatigued, rest on fence, struggle in areas (e.g., scrambles) ▪ Strength; ability to control opponent ▪ Durability; amount of strikes absorbed (in what manor) ▪ Conditioning; aerobic and anaerobic capacity ▪ Ability to maintain higher work rate in later rounds/scrambles ▪ Anthropometric considerations; height, reach (arm/leg) ▪ Comparison of opponent vs Athlete
MENTALITY	▪ While the mental and psychological aspects of fight strategy are beyond the scope of this section, it is worth noting the existence of the mental game and that the mental qualities of a fighter can be ascertained when reviewing fight footage. For example, common fight traits can include; "front runner", "looks for a way out", or "has no quit".


CHAMPION
MCMXCIII



PART 3
SECTION 57



SECTION 57: GOAL SETTING

By Bo Sandoval, Reid Reale and Dean Amasinger

Goal setting during fight-camp is about prioritizing critical objectives that the team feels will directly and positively influence the outcome of the upcoming bout. Targeted off-camp preparation plays a major role in confident decision making when it comes time to preparation for a bout. Fight-camp should be spent optimizing strengths, both offensively and defensively, and rehearsing strategies and game plans that will contribute to victory. Fight-camp objectives should largely focus on i) weight management/fueling strategies, ii) injury management/mitigation and iii) harmonizing technical and non-technical training volumes and intensities. Table 57.1 gives insight into the thought process from different performance perspectives when focusing on key goals and objectives during fight-camp.



WEIGHT MANAGEMENT

Athlete requires no weight descent (approx. 10 percent above weight division):

- Optimal fueling of all training sessions
- Moderate-to-high protein intake
- Nutrition supports recovery and adaptation
- Very low or no energy deficit required

Athlete requires realistic, achievable, non-aggressive weight descent (low risk of missing weight):

- Optimal fueling of key training sessions (e.g., sparring)
- Moderate energy deficit required
- Moderate-to-high protein intake

Athlete requires aggressive weight descent (moderate-to-high risk of missing weight):

- Substantial energy deficit required
- Optimal fueling of only the most important sessions
- Protein intake slightly reduced
- Focus placed on low-energy foods promoting satiety

Athlete requires extremely aggressive weight descent (high-to-very-high risk of missing weight):

- Optimal fueling sacrificed to achieve aggressive energy deficit
- Protein intake reduced
- Focus placed on low-energy density foods promoting satiety



TECHNICAL TRAINING

Each Session

- Set goals and intentions before each session
- Stay within prescribed session intensity
- Visualization post-training

Sparring

- Win sparring rounds (Referee to judge)
- Maintain work capacity (strikes or takedowns per minute)
- Implement game plan and make appropriate decisions (Keep tally of positive and negative outcomes)
- Awareness of points to work on from sparring review (Make notes)

Live Work

- Keep score of outcomes
- Make appropriate decisions (Keep tally of positive and negative outcomes)



NON-TECHNICAL TRAINING

Complement weight-management tactics:

- Low-intensity conditioning work while glycogen depleted (e.g., upon waking up or after high-intensity training sessions)

Complement and support injury maintenance and mitigation:

- Daily interventions involving mobility, stability and activation exercises
- Prescribed based on orthopedic screen and injury history

Compliment and support technical training strategies & tactics

- Style-specific energy system requirements
- Style-specific strength and power requirements
- Target performance objectives relevant to the overall fight-camp and time frames based off of physical assessment data





PART 3
SECTION 58



SECTION 58: FIGHT-CAMP ASSESSMENTS AND DIAGNOSTICS

By Kyle Larimer and Felix Falkenberg

In order for physical attributes to contribute to performance, they must be improved (or at least maintained) throughout fight-camp. The proper selection of diagnostics during fight-camp will help ensure the current programming design is targeting the appropriate variables. Not all baseline assessments can or need to be implemented during this time. The athlete's physical profile, constructed through off-camp and pre- and early-fight-camp, as well as his or her fighting style, will help determine which assessments to utilize.

FIGHT CAMP DIAGNOSTICS

INDIVIDUALIZED NEEDS ANALYSIS APPROACH

CONSIDERATIONS

TIME CONSTRAINTS
FIGHT STYLE
MENTAL BOOST (+ TRENDS)
PRE/EARLY FC: DETERMINE/REINFORCE CAMP
NTT TRAINING FOCUS
MID FC: NECESSARY ADJUSTMENTS
LATE FC: ASSESS IF GOALS ARE ACHIEVED

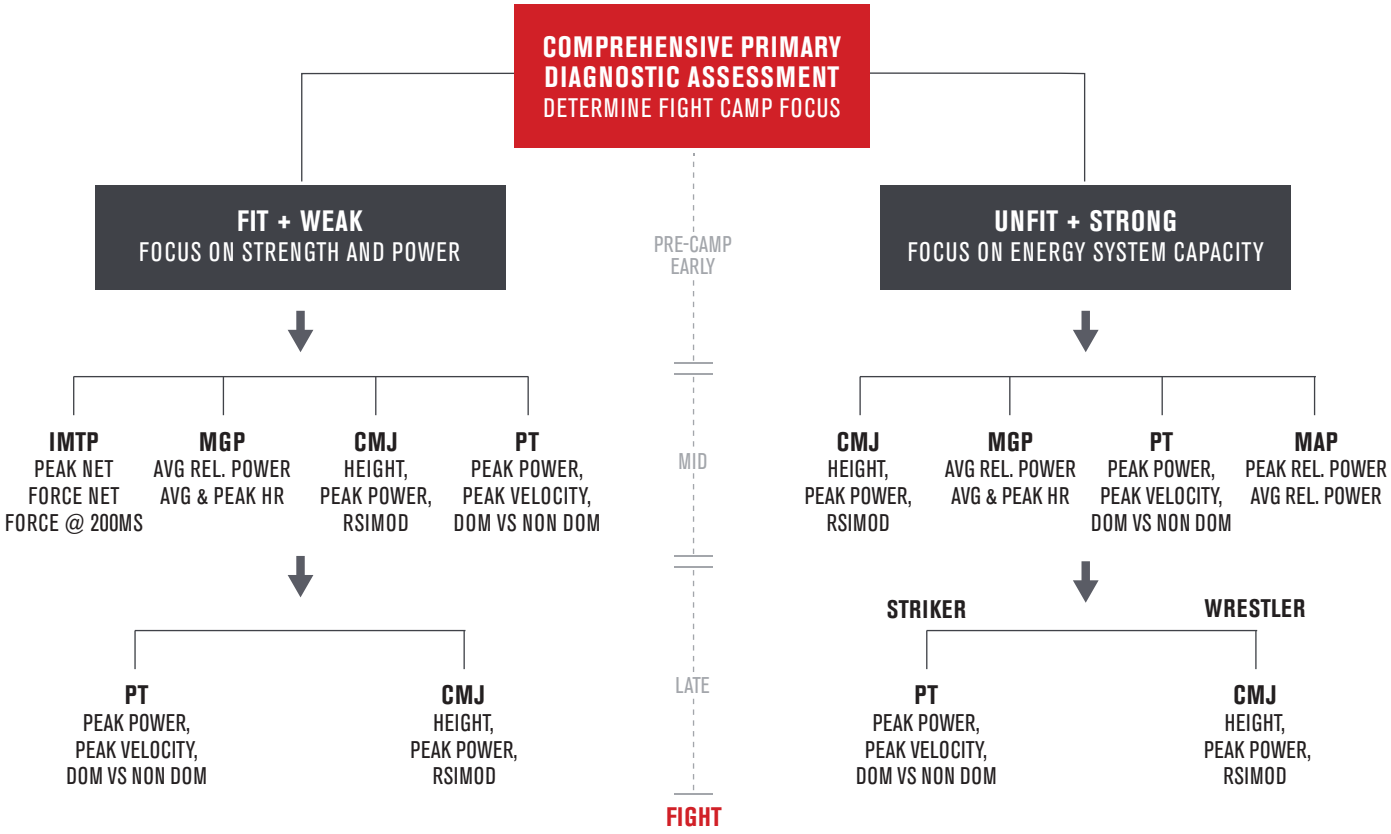
TEST SELECTION

PRIMARY	SECONDARY
PUNCH THROW	6s RST
CMJ	ATHLETIC SHOULDER (ASH) TEST
IMTP	LOADED CMJ
MGP	LOADED CHIN-UPS
MAP	SQUAT JUMP
GRIP	DROP JUMP
PULL END	REPEATED JUMPS
VO2MAX	OTHER

DATA EVALUATION

MAGNITUDE OF CHANGES
PERCENTAGE CHANGES
COMPARISON TO WEIGHT CLASS
COMPARISON TO CAMP STATUS
TREND ANALYSIS
DATA AND TREND REPORTING (MINDSET)
PEAKING





MGP – max glycolytic power **MAP** – max alactic power **IMTP** – isometric mid-thigh pull **CMJ** – countermovement jump **PT** – punch throw





PART 3
SECTION 59

SECTION 59: MENTAL SKILLS & PREPAREDNESS

By Micah Schnurstein, Richy Walsh and Forrest Griffin

Mental preparedness is broadly defined as the ability to deal with obstacles while keeping a rational and positive mindset. Optimal mental preparedness will enable a fighter to better use his or her individual skills and physical attributes against an opponent, especially when stress levels and stakes are high. It will also help a fighter stay in a positive mindset, prevent burnout, build confidence and instil self-efficacy (i.e., a person's belief he or she can effectively influence the outcome of a situation) in preparation for a fight. The mental-skills training techniques in this section work to improve one's mental preparedness for MMA training and ultimately for the fight itself. Mental-skill training, like any other training, improves based on the frequency, consistency and dedication of the individual. As such, a fighter who uses these techniques during the off-camp phase will be better prepared mentally than a fighter who just attempts to use them in fight-week or not at all.

Training and learning mental skills do not have to be complex, and most coaches informally deliver mental skills at every practice. For example, shadowboxing and bag work can be opportunities to train visualization and imagery. Jogging around with hands up after a hard practice (i.e., the "victory lap") utilizes visualization and can enhance a fighter's positive mindset and self-confidence. Coaches who check in to keep fighters focused on the drill or task at hand promote present-moment awareness. Theses skills also allow fighters to change their arousal levels in training (e.g., ramping up for sparring and coming back down for recovery). Examples of how various mental skills could be used in different stages of a training session are detailed in Table 59.1

"ROUTINE MAKES THE EXTRAORDINARY A LITTLE MORE ORDINARY."

There are different types skills that can be used by fighters to increase mental preparation during the various stages of camp (e.g., visualization, film study, mindfulness, sensory awareness, thought identification, proprioception). Each skill can mentally benefit a fighter in a different area to help him or her increase physical performance. Visualization supports physical and mental performance by rehearsing and successfully executing specific techniques so that they are instinctive and automatic during a fight.

Film study can augment visualization and is an opportunity for a fighter to identify mistakes a future opponent has made and visualize him or herself capitalizing on them. The inverse of this would be to watch an opponent's successful techniques and visualize the appropriate counters to those techniques. These visualization examples can mentally reinforce appropriate techniques and tactics for a fight while also building confidence in being able to exploit an upcoming opponent's vulnerabilities. Mindfulness allows a fighter to pay attention to what's "here and now" (e.g., surroundings, thoughts, feelings), without judgement. Sensory awareness is a mindful technique that helps to "ground" fighters to the present moment by bringing attention to their senses. A fighter who is present "in this moment" can increase focus on values in practice, sparring and strength and conditioning. Thought identification helps to increase periods of present thinking to support focus on fight values, rather than dwelling on the past or worrying about the future. Proprioception increases a fighter's ability to be mindful of his or her body while training and acquiring new skills. This allows a fighter to have awareness of body position, weight, trajectory and balance, which helps identify miscues and correct execution. An example of how to use proprioception while executing a high kick is in Figure 59.1.

PRE-PRACTICE AND WARM-UP

As detailed in Table 59.1, there are many opportunities in training to engage and enhance mental skills. The first is usually during warm-up. It is important that fighters think of this time not just as getting ready physically but also mentally. The warm-up is a good time for a fighter to become mindful of the present moment (e.g., sensory awareness), focus on goals for the session (e.g., "How am I going to get the most out of this practice?" or "What am I learning today that is going to help me win my next fight or become a world champion?") and then begin to bring focus toward execution. Indeed, it is not uncommon for fighters to struggle with negative thinking or emotions when warming up (e.g., "This session is going to be brutal" or "Will I get my condition right in time?"). In this instance, a fighter could use the mental skills of thought identification and sensory awareness to return to a more positive state of mind. For example, a fighter who has practiced thought identification would, in this situation, recognize worried thoughts based on the future and the lack of focus on the present moment. The fighter could then use sensory awareness by noticing his or her feet on the ground, what he or she sees in the room or the feeling of the tape on his or her hands to bring awareness to the present moment. This can be followed by refocusing on the value wanted from this practice and then using thought identification and mindfulness to help return focus when the mind wanders.

TABLE 59.1
MENTAL SKILL TRAINING OPPORTUNITIES AROUND MMA TRAINING SESSIONS

WHEN	STAGE / ACTIVITY	MENTAL SKILL(S)	PURPOSE
Pre/Post Training	Film study	Visualization, Sensory Awareness, Thought Identification	Strategy building, Identifying path to victory, Self-efficacy
During Session	Warm-up	Thought Identification / Sensory Awareness / Focus on value	Mind & Body present in practice / Identify and focus on training goal
	Shadowboxing / Bag work	Visualization / Proprioception	Focus on strategy, technique, and execution
	Post Practice Routine	Visualization (Victory Lap) / Positive Identification	Increase positive self-talk and confidence
	Cool Down / Recovery	Diaphragmatic Breathing / Sensory Awareness / Move to next value	Transitioning to the next camp value (e.g. diet, sleep, cardio)
Fighting / Sparing	Pre-Sparing Warm-up Routine / Ritual	Diaphragmatic Breathing / Thought Identification / Sensory Awareness / Visualization	Increased arousal management / Increased focus on camp values
	Pre-fight Warm-up Routine / Ritual	Diaphragmatic Breathing / Thought Identification / Sensory Awareness / Visualization	Increased arousal management / Increased focus and application of camp values

DURING PRACTICE

A regular part of MMA training is shadowboxing and bag work. This should not be a time for a fighter to let his or her mind wander aimlessly. Rather, this is a moment for a fighter to be present in body and mind as to experience what it feels like to correctly apply and execute the identified technique (e.g., proprioception). For instance, as a fight draws closer, bag work can be used to focus on defending specific techniques from an upcoming opponent and countering with the appropriate combinations identified for the fighters game plan (see Section 57).

Another opportunity for athletes to utilize mental skills is sparring. Fighters who create a pre-sparring routine will consistently put themselves in a position to get the most out of sparring sessions. Using mental skills while sparring supports the optimal level of arousal and attention to direction. Fighters can be present by noticing their feet on the ground, noticing different things they see in the gym or by feeling the temperature of the room. This can be followed by identifying the sparring focus (e.g., defending the low-leg kick) and visualizing how this looks when executed correctly. Pre-sparring routines should be similar to an athlete's fight-day routine to help normalize the events of fight day and maintain optimal levels of arousal and focus before a fight. When these mental skills are trained over a full fight cycle (i.e., off-camp and fight-camp), a fighter can feel confident knowing they got the most out of their sparring sessions.

POST-PRACTICE

Cool-down routines are an effective opportunity for fighters to use mental skills and transition to their next training value. For instance, at the end of a practice (particularly a difficult one), fighters often will take a "victory lap," raising their hands in the air as if to show judges that they won and that they're not tired. This is another great opportunity to engage in positive self talk (e.g., "Nobody works harder than I do" or "Nobody wants to win more than I do.") Using this mental skill helps to build confidence after completing a difficult practice and supports increased mood and self-efficacy. Meanwhile, after practice, fighters often engage in some form of cool-down or recovery that may include stretching, taking an ice bath or using a sauna. This is a perfect opportunity to use mental skills such as diaphragmatic breathing (e.g., box breathing) to lower arousal, down regulate the body and transition from "mobilizing energy" to "restoring energy" (sympathetic expenditure to parasympathetic restoration within the autonomic nervous system).

FIGURE 59.1

USING MINDFULNESS, SENSORY AWARENESS AND PROPRIOCEPTION SKILLS TO AUGMENT A FIGHTER'S ABILITY TO BE AWARE OF HIS OR HER BODY WHEN LEARNING NEW SKILLS.

GOAL: INCREASE APPLICATION AND EFFECTIVENESS THROUGH MINDFULNESS AND AWARENESS DURING TRAINING



TIPS

- After session observe what you notice
- Pick a different body part each session
- Explore with team/coach
- Describe experience and don't judge

PRACTICE

- Pick area of body during the application of the move
- Notice what is present with muscles, body, feelings etc.
- When mind wanders, notice and bring it back

TABLE 59.2

AN EXAMPLE OF HOW MENTAL SKILLS CAN BE PERIODIZED ACROSS A FIGHT PREPARATION

MENTAL SKILL(S)	OFF-CAMP GENERAL	OFF-CAMP SPECIFIC	FIGHT-CAMP: EARLY	FIGHT-CAMP: LATE	COMPETITION	TRANSITION/RESET
Visualization	Technical visualization particular move-non-competitive	Technical visualization of implementation of moves and context. Tactics	Visualization of hard sparing sessions and mental mapping	Visualization of fight and rehearsal of event	Fight day visualization routine	Fighter video analysis and visualization
Goal Setting	Goals around individual sessions/techniques	Goals around more specific areas of training	Sparing goals/review session goals	Fight gameplan goals and execution	Fight specific goals	Re-evaluation of post-fight goals
Relaxation, Resets, & Breath Work	Diaphragmatic breathing, Grounding techniques, Self-Care	Diaphragmatic breathing, Grounding techniques, Self-Care	Diaphragmatic breathing, Grounding techniques, Self-Care	Diaphragmatic breathing, Grounding techniques, Self-Care	Diaphragmatic breathing, Grounding techniques, Self-Care	Diaphragmatic breathing, Grounding techniques, Self-Care
Self-talk	Positive self-talk, practicing catching the negative, redirecting focus	Positive self-talk, practicing catching the negative, redirecting focus	Positive self-talk, practicing catching the negative, redirecting focus	Positive self-talk, practicing catching the negative, redirecting focus	Positive self-talk, practicing catching the negative, redirecting focus	Positive self-talk, practicing catching the negative, redirecting focus
Mindfulness	Thought Identification, Sensory Awareness, Proprioception	Thought Identification, Sensory Awareness, Proprioception	Thought Identification, Sensory Awareness, Proprioception	Thought Identification, Sensory Awareness, Proprioception	Thought Identification, Sensory Awareness, Proprioception	Thought Identification, Sensory Awareness, Proprioception
Strategic Focus	Study of non-fight related content, can be broad and nonspecific to MMA	MMA based techniques and fight study	Fighter and opponent video analysis and evaluations	Highlights/Fighter videos and sparing reviews, positive based video reviews	Highlight videos, either personal or favourite fights	Review of fight footage, coach/ fighter meeting debrief, find the positives

Fighters can also use thought identification to identify thoughts associated with dwelling in the past or worry about the future and "let them go" by bringing awareness to the present moment and moving to the next valued activity (e.g., post-workout recovery shake, meal).

After considering where certain types of mental skills best fit into each training session, coaches can begin to plan how to systematically incorporate and utilize mental skills throughout a fight preparation cycle. Table 59.2 outlines an example of how mental skills can be periodized across a fight cycle. For example, mental skills used while shadow boxing may vary, according to the phase of a fight cycle. Fighters in the off-camp phase might work on a specific technique, visualizing it being executed correctly, through sensory awareness and proprioception. Meanwhile, in fight-camp, fighters may visualize themselves against an upcoming opponent's favored techniques and countering with successful techniques of their own. Assessing the mental-skill needs of an athlete before prescribing which skills to train during a fight preparation can be based on athlete/coach experience and subjective views (e.g., using a questionnaire) and consulting with a trained sports psychologist. Giving the fighter choices on which mental skills to train is also an effective way of developing athlete ownership and buy-in into mental-skills training.

Training mental skills in off-camp should align with the key philosophies of learning, technical upskilling and self-development. Along with the technical aspects of MMA, off-camp is the time to develop the base of the targeted mental skills the fighter will rely on in the fight-camp and the fight itself (e.g., thought identification, sensory awareness, mindfulness). Meanwhile, a fighter having a "winning" mindset is a key tenet of fight-camp. This can be curated by coaches with the selection of sparring partners to allow fighters to get enough "wins" in training (See Section 61) along with the appropriate mental-skills training.

"MENTALLY, YOU WANT TO KNOW THAT YOU'VE DONE THE WORK... THAT YOU'VE DONE EVERYTHING IN YOUR POWER IN TRAINING TO ENSURE YOU SUCCEED IN THIS FIGHT. YOU ALSO WANT TO KNOW THAT YOU WILL NOT QUIT ON YOURSELF... THAT YOU HAVE BEEN IN DIFFICULT SITUATIONS IN PRACTICE AND HAVE OVERCOME THEM!"

FORREST GRIFFIN, UFC HALL OF FAMER





PART 3
SECTION 60

SECTION 60: FIGHT-CAMP: TECHNICAL SESSION PLANNING

By Dean Amasinger and Felix Falkenberg

The majority of technical training in fight-camp depends on what has been accomplished by the fighter in off-camp. As such, the information presented here assumes a fighter has achieved satisfactory results during off-camp, and a fight-camp can be as short as six weeks to optimally prepare the athlete for a fight. As mentioned in Section 56, technical sessions in fight-camp should see a shift in the training emphasis in several ways compared to off-camp. First, and still guided by a fighter's technical analysis, there should be a shift to focus more on a fighter's strengths in technical training, as compared to weaknesses (unless improving these weaknesses in fight-camp is vital based on their upcoming opponent). In most cases, technical sessions should also be focused on integrated MMA techniques, rather than individual martial arts skills.

Further, and perhaps the most important consideration during fight-camp, technical sessions should focus on the style in which the fighter wants to compete, fight IQ and decision-making around high-risk techniques—which all depend on the fighter and his or her game-plan tactics (see Section 57). This necessitates a greater amount of tactical work in technical training, as compared to off-camp, and these tactics should have context to and are relevant to the fighter's game plan. Another potential difference with off-camp is that the techniques trained may be unrelated at times to make sure they meet the tactical needs of the fighter. To complement the increased tactical focus, technical training sessions in fight-camp should shift toward more intense shorter sessions with increased live work and sparring compared to drilling. Again, this can be planned and monitored with the ratio of live:drill work in training and the coach's intended ratings of perceived exertion for the athletes in training sessions (sRPE). An example six-week fight-camp with different live:drill ratios and coach-intended sRPE is shown in Table 60.1. Although creativity is still encouraged to a degree, it is important that in this live work and sparring, a fighter concentrates on purposefully doing what he or she would do in an upcoming fight based on the game plan. Fighters and coaches should also complement this focus on the game-plan tactics by encouraging a mindset with the intention to win every second of every round of live work and sparring, which is a shift from the learning and experimental mindset promoted in off-camp.

Building from the off-camp specific preparation, the increased live work and sparring in fight-camp will also help further develop the conditioning needed for MMA competition (i.e. "getting fit from the sport"). This can also be augmented by the use of MMA-specific conditioning sessions (e.g., "shark tank") and live work or sparring that is manipulated to be above the level experienced in a fight (e.g., imposing higher work rates during sparring rounds, more sparring rounds than in a fight, shorter rests between sparring rounds than in a fight). To compensate this increase in technical sport-based conditioning, there will also ideally be a decrease in non-technical conditioning work during fight-camp, if possible, considering the fighter's weight descent needs.

IF OFF-CAMP IS GEARED TO PREPARE AND POTENTIATE THE BODY, THEN FIGHT-CAMP IS MORE ABOUT PREPARING AND POTENTIATING THE MIND.

Once a certain level of conditioning is achieved, the limiting factor in the ability to maintain output and keep a high work capacity is not determined by physical conditioning. It is the ability to stay composed, the ability to pace a fight, the ability to maintain appropriate arousal and the ability to be in control of one's breath. Although these skills have a both physical and mental components, they can be primarily developed and honed through recreating what the athlete is going to experience in a fight. There are, of course, challenges recreating what a fighter will experience in competition in training, as the contact nature of the sport means injury risk is much higher than in other sports. However, where possible and within reason, recreating the experience of a fight should be prioritized within fight-camp. Examples of how to do this include "fight" wrapping hands and training with a referee on sparring days or always training with MMA gloves and including striking in grappling sessions (even if striking is de-emphasized).

Another important component of fight-camp is the reviewing of sparring. The purpose of a sparring review is to identify points from sparring that went well but could have been executed better or other key points that did not go well and the coach feels need to be corrected. The selection of these key points should be formulated from a video review of sparring and conversations that arise during the review between coach(es) and athlete. Once these key points have been identified, it is worthwhile to schedule a training session within close proximity to the sparring session under review (e.g., in the afternoon on the same day after a morning sparring session) that focuses on the key points from sparring that a fighter needs to improve upon. An example of an individual training session that functions as a sparring review during fight-camp is provided in Figure 60.1.

TABLE 60.1

AN EXAMPLE OF A 6-WEEK FIGHT-CAMP

	FIGHT CAMP					
	EARLY			LATE		
	-6	-5	-4	-3	-2	-1
COACH PLANNED	MODERATE	HIGH	LOW	HIGH	MODERATE	LOW
COACH INTENDED sPRE	5.2 ± 1.9	5.4 ± 1.7	5.2 ± 2.3	5.3 ± 1.8	4.8 ± 1.7	4.4 ± 0.5
LIVE: DRILL	24% : 76%	27% : 73%	25% : 75%	31% : 69%	21% : 79%	0% : 100%
TOTAL LIVE RD	43	51	34	60	33	0
TT : NTT DISTRIBUTION	92% : 8%	94% : 6%	94% : 6%	95% : 5%	94% : 6%	95% : 5%

FIGURE 60.1

AN EXAMPLE OF A MODERATE-HIGH INTENSITY SPARRING REVIEW TRAINING SESSION

(COACH INTENDED SRPE 4-5)

SESSION MINDSET TO ALLOW ATHLETE TO SET INTENTION.

ALL SESSIONS IN GLOVES

LOW INTENSITY TECHNICAL DRILLS

UNCONNECTED TECHNICAL STREAMS

TACTICAL-TECHNICAL WORK THAT CAN NOT BE SAFELY DONE IN SPARRING

VISUALIZATION REVIEW TO FURTHER COMPOUND THE CORRECTIONS FROM THE TECHNICAL SESSION

WEEK 8
DATE:
START TIME 09:00
SESSION LENGTH: 69

FIGHT CAMP: SPARRING REVIEW

COMPETITVE

EQUIPMENT REQUIRED: 8OZ GLOVES, MOUTH PIECE, CUP

DRILL TIME	DRILL	DETAILS	COMMENTS	INTENSITY
12	FOOTWORK/HEADMOVEMENT DRILL	10 MIN 2 MIN REST		
10	RECLAIMING THE CENTER OF OCTAGON	9 MIN 1 MIN REST	START WITH BACK 2 FEET FROM THE FENCE	
5	LIVE - W/ STRIKES & TAKEDOWNS	2 X 2 MIN 1 MIN REST	RESET WHEN CENTER IS REACHED OR BACK IS AGAINST THE FENCE	
10	MOUNT ESCAPE COMBO	9 MIN 1 MIN REST		
5	LIVE - FROM MOUNT (W/ UNDERHOOK)	2 X 2 MIN 1 MIN REST	IN 3'S SWITCH AFTER 2 GOES	
12	KNOCKDOWN DRILL	4 X 2 MIN 1 MIN REST	12 X IN THE CENTER 2 X CLOSE TO FENCE	
5	VISUALIZATION REVIEW			
5	COOL DOWN			
69				


Reebok



PART 3
SECTION 61

SECTION 61: FIGHT-CAMP: SPARRING CONSIDERATIONS

By Richy Walsh, Forrest Griffin and Felix Falkenberg

In fight-camp, sparring will normally become the most important session(s) of the week and will change considerably from off-camp to fight-camp. There are various considerations around the degree to which sparring should change. The first consideration is as a fighter gets nearer to the fight, sparring often gets closer to the actual competition environment to maximize transfer (while minimizing any risks or danger that may derail the fight-camp). The fighter's game-plan and style should also shape in sparring sessions during fight-camp and may need to be manipulated to be particular to their upcoming opponent. Another consideration is the previously mentioned change in mindset from off-camp to fight-camp with a more competitive "winning" focus now promoted by coach(es) and the fighter. This means there should be less attempting new techniques in sparring and more developing the fighter's game plan and working on technical strengths during sparring. This technical-strength focus during fight-camp may need to be balanced with some focus on a particular weakness if it is necessary to prepare a fighter for an upcoming opponent and to help execute the game-plan. For example, a striker with poor fence takedown defense may need to continue working this quality in fight-camp sparring if an upcoming opponent utilizes takedowns on the fence.

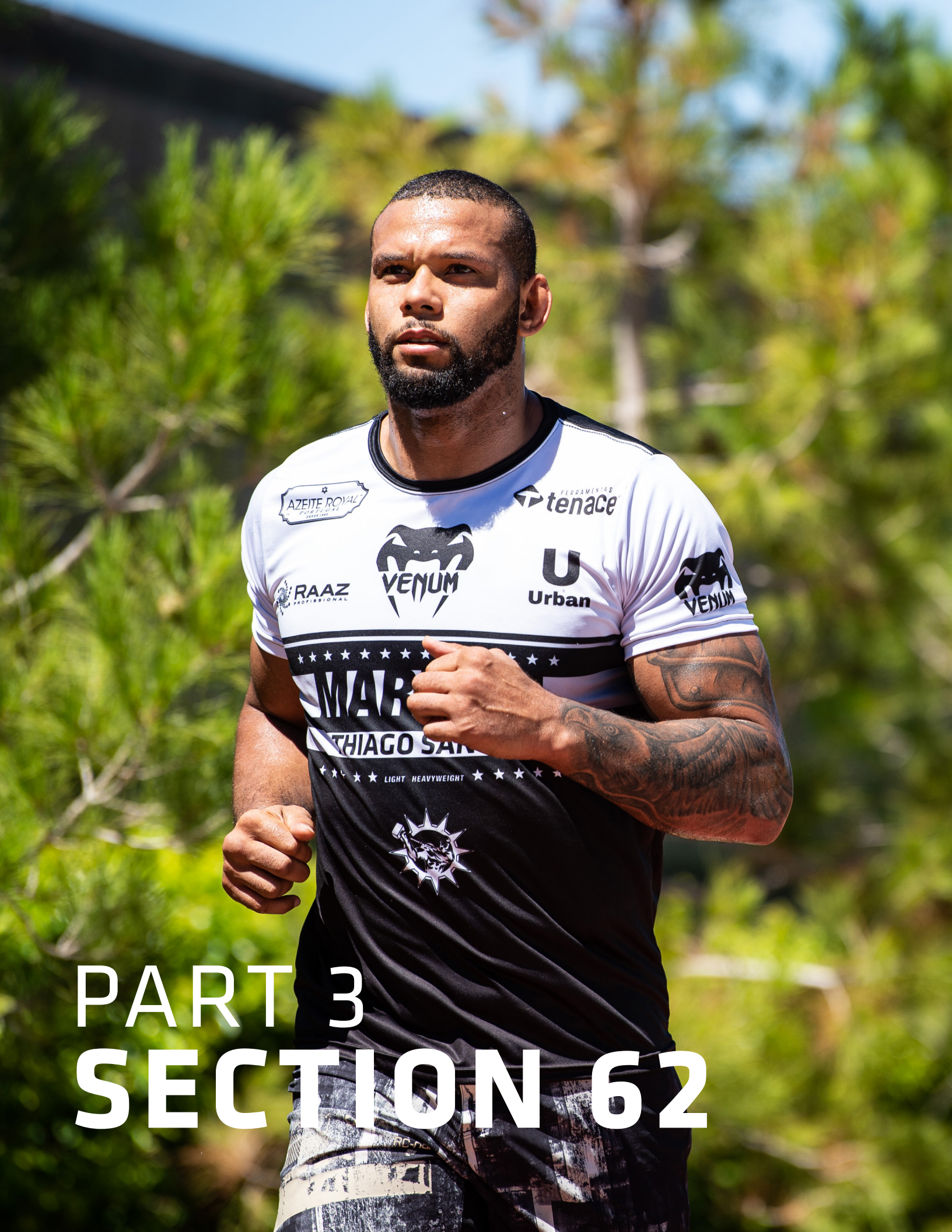
A typical sparring session in fight-camp may involve a fight warm-up or drilling followed by five five-minute full MMA rounds with big or small gloves and some pad work or drills (potentially based on key points a coach wants to highlight to the athlete from sparring) to end the session. The sparring focus during fight-camp should be predominately full MMA rounds that, as mentioned, also match the athlete's style and game plan for the upcoming fight. The intensity levels of sparring in fight-camp will obviously be more competitive and realistic than in off-camp. The inclusion of full MMA rounds should naturally raise the intensity of sparring as compared to the individual martial arts sparring (e.g., boxing, wrestling or Brazilian jiu-jitsu only) seen in off-camp. Despite this natural increase, it is also vital that coaches and fighters promote an appropriate intensity of sparring to get athletes closer to (or even above) the level of competition, while still being moderated by coach and athlete, if needed. Using the levels of sparring (Table 30.1), the sparring in fight-camp should reach the maximum of Level Five and be tapered down close to the fight-week. Safety equipment (e.g., pads, head gear) should be used where applicable to minimize risk.

In fight-camp, it is also advocated that if it necessary to do extra sparring, this should be comprised of situational or positional MMA work (e.g., ground-and-pound, wall or clinch work) rather than individual martial arts work. This should help further improve the transfer of sparring work to competition. The number of sparring rounds, rest periods and partner selection should be arranged to create the environment and intensity of the upcoming fight while minimizing risk for the fighter. Further considerations for individual sparring sessions in fight-camp are listed in Table 61.1. These considerations should not only help the fighter get physically prepared for competition but also mentally prepared. This is important, as being fully prepared for a fight is not just having great technical ability and conditioning, it is also being prepared mentally to fight.

TABLE 61.1

DIFFERENT CONSIDERATIONS FOR INDIVIDUAL SPARRING SESSIONS WITHIN FIGHT-CAMP

NUMBER OF SPARRING ROUNDS	Coaches should aim for quality over quantity and getting just enough for the goals of the particular sparring session.
SPARRING COMMUNICATION	Speak in the way coaching points will be delivered during an actual fight so they become comfortable with the style and the way information is presented.
PARTNER ROTATIONS	Some sessions require the same partner for the complete session, alternating partners between rounds or in rounds ("shark-tank"-type situations).
PARTNER SELECTION	Use partners that are from the same weight class (or one above or below) to allow hard competition while minimizing risk.
PRE-FRAMING	Pre-framing can be utilized to create sparring situations that mimic the opponent's tendencies.
REPLICATION OF COMPETITION ENVIRONMENT	Walk-out music, lights, crowd noise to help prepare for the upcoming fight experience and associated competition anxiety or "nerves."
FIGHT WARM-UP	On sparring days in fight-camp, rehearse and practice the preparation and warm-up (full or segments) that will be used on fight day.
CORNERING DUTIES	Develop coach and fighter corner communication for in and between rounds.
SPARRING REVIEW	Adding both video and physical sparring review sessions of key points the coach(es) or athletes feel need to be addressed. See section 60 for more information about sparring review.
GAME-PLAN IMPLEMENTATION	Set process and outcome goals in sparring to apply the game-plan where appropriate and win all exchanges and areas.
MENTAL PREPARATION	Rehearse targeted mental skills around and in sparring (See Section 60). May be as simple as focus cues (e.g., hands wrapped, water on feet) to help fighter "zero-in" on upcoming sparring session.
CLOCK DISCIPLINE	Adhering strictly to clock times between rounds, building efficiency.



PART 3
SECTION 62

FIGHT-CAMP: NON-TECHNICAL TRAINING TARGETS

By Duncan French and Bo Sandoval

The purpose of fight-camp is to optimize athlete performance for competition. Technical training takes priority with non-technical training aligned to support sport-specific needs. As a fighter moves through fight-camp, the distribution of non-technical training targets is critical to allow a fighter to arrive at competition in peak condition. The application of strength and power training stimuli must serve to complement their energy-systems development. Further, both these domains must optimize the training gains from off-camp. Managing non-technical training targets is a complex process at the most critical time of preparation.

STRENGTH, POWER & SPEED

FORCE

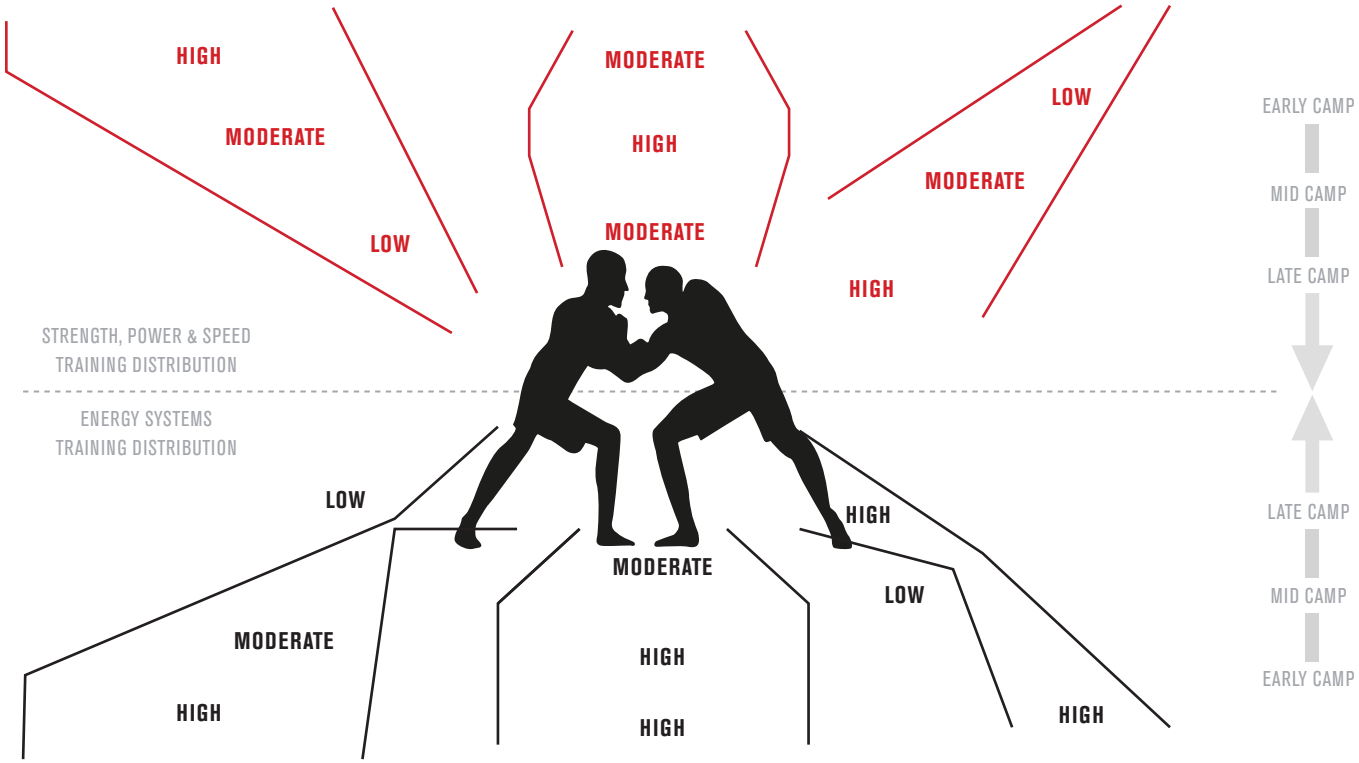
Maximal force development should be emphasized in off-camp. However, heavy loading in the early part of fight-camp (weeks 1-3) can be beneficial. Training focused on maximal force should be reduced significantly as fight-camp progresses to avoid fatigue.

POWER

Maximal power should be prioritized throughout fight-camp as the critical non-technical attribute. Power training volume should be increased to peak during mid-fight-camp and then gradually reduced to avoid fatigue.

VELOCITY

Maximal velocity is critical in supporting explosive striking, takedown offense/defense and scrambles. Very high-quality velocity training should increase throughout fight-camp, peaking immediately prior to competition.



AEROBIC

Aerobic "base" conditioning should primarily be performed in off-camp. In fight-camp, it can be utilized at the start to develop the aerobic threshold and promote recoverability. In late fight-camp, it can be used to support weight descent.

GLYCOLYTIC

Glycolytic/lactic capacity is a determining factor for success in MMA. Training glycolytic capacity using fight-specific characteristics should be emphasized during fight-camp, with a taper toward competition to remove fatigue.

ALACTIC

Explosive **alactic** energy production is critical for supporting the high-intensity efforts seen in MMA. The rate and capacity of alactic energy production should be emphasized early in fight-camp and then again in late fight-camp.

ENERGY SYSTEMS





PART 3
SECTION 63

SECTION 63: CONCURRENT TECHNICAL AND NON-TECHNICAL TRAINING CONSIDERATIONS IN FIGHT-CAMP

By Bo Sandoval, Gavin Pratt and Dean Amasinger

Creating a collective combat approach during fight-camp requires a systematic process involving consistent communication between technical coaches and performance staff. Discussions should revolve around the athlete and management of training load (e.g., volume and intensity) for each session. As mentioned in Section 17, these outputs can be classed as having a high, moderate or low impact on subsequent training sessions for both technical and non-technical training modalities (See Table 63.1).

It is especially important in fight-camp to distinguish and collaborate between staff on the differences in training loads between technical and non-technical training. If this is not accomplished, there is potential to create a training schedule for an athlete that results in a "flatline" training load across the course of a micro- or meso-cycle. In other words, all training sessions are either moderate or high, giving the athlete no opportunity to recover from hard training and "flatlining" potential positive adaptations and fight readiness (See Figure 63.1).

As such, the UFC PI's collective combat approach aims to synchronize technical and non-technical training loads to produce a schedule that undulates across the week and creates a "pulse" to help breathe life into an athlete's performance outcomes. To do this effectively, both technical and non-technical training should be concurrently managed so overall training loads optimize recoverability and adaptation (See Figure 63.2).

The ratio of different training components (e.g., live work to drilling) based on the type of training sessions and their specific outputs can also be used to support these scheduling principles and generate a planning structure that can be followed by all support staff (See Figure 63.3). Feedback from the athlete surrounding the predetermined coach-planned training loads can also help long-term training prescriptions and future program alterations.

TABLE 63.1
DESCRIPTION OF HIGH, MODERATE, AND LOW IMPACT ON SUBSEQUENT TRAINING WITHIN TECHNICAL AND NON-TECHNICAL TRAINING

	HIGH IMPACT	MODERATE IMPACT	LOW IMPACT
TECHNICAL TRAINING	LIVE WORK/SPARRING	COMPETITIVE DRILLING	TECHNICAL DRILLING
STRENGTH & POWER (SP)	MAXIMAL STRENGTH STRENGTH-SPEED STRENGTH-ENDURANCE	POWER SPEED-STRENGTH	REMEDIAL CORE
ENERGY-SYSTEM DEVELOPMENT (ESD)	ANAEROBIC GLYCOLYTIC	ANAEROBIC ALACTIC	AEROBIC


THORNE
RAPTOR
RAPTOR

FIGURE 63.1

AN EXAMPLE OF A "FLATLINE" SCHEDULE INDICATING MODERATE-HIGH LOADING FOR ALL COMPONENTS OF TRAINING, USUALLY RESULTING IN A FATIGUED/OVER-TRAINED ATHLETE

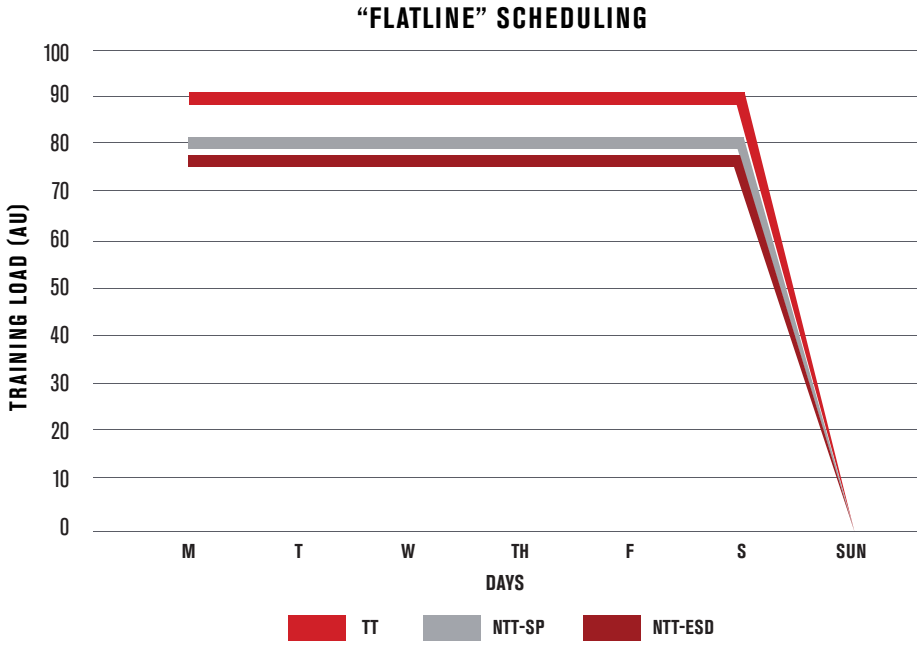


FIGURE 63.2

"PULSE" SCHEDULE HIGHLIGHTING HOW THE TRAINING LOAD OF EACH COMPONENT CREATES A RHYTHMICAL-LIKE HEARTBEAT ACROSS THE COURSE OF A WEEK, ALLOWING FOR RECOVERY AND ADAPTATION

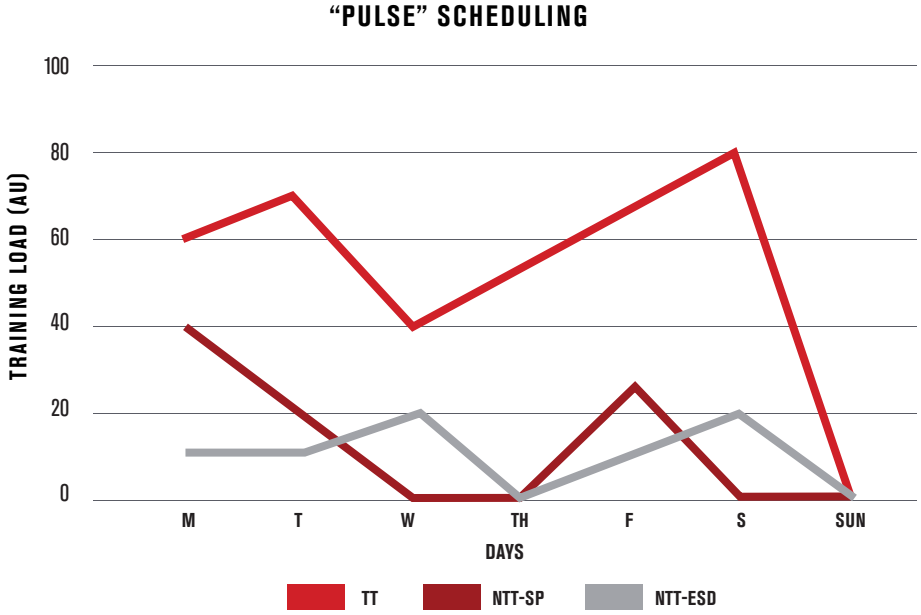
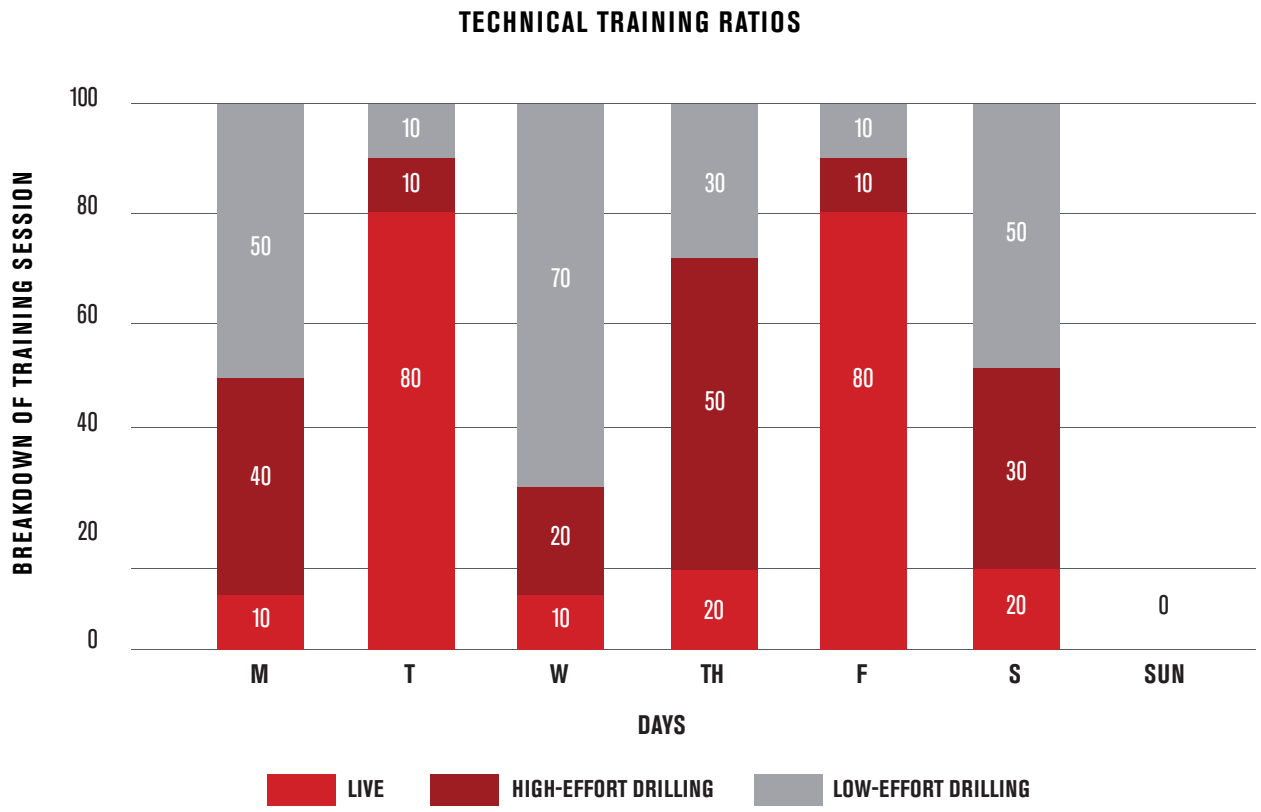


FIGURE 63.3

AN EXAMPLE OF HOW DIFFERENT COMPONENTS OF NON-TECHNICAL TRAINING CAN ALIGN WITH TECHNICAL TRAINING THROUGHOUT A WEEK DURING EARLY FIGHT-CAMP



	MON	TUES	WED	THUR	FRI	SAT	SUN
	POWER	MAXIMAL STRENGTH			STRENGTH-SPEED/ POWER		
	ALACTIC	LACTIC			ALACTIC	AEROBIC (WEIGHT CUT FOCUS)	


3
00:59



PART 3
SECTION 64

SECTION 64:
HOW TO IMPLEMENT SPORTS VISION TRAINING

By Kyle Larimer

WHAT IS SPORTS VISION TRAINING, AND WHY IS IT IMPORTANT?

Sports vision training is the use of visual and perceptual tasks to enhance visual and sensory capabilities to improve athletic performance and potentially reduce injury. The Sports Vision Pyramid represents the foundational visual and cognitive components which combine to result in sporting action. Sports vision training targets improvement in these trainable visual components with the goal of improving sport performance.

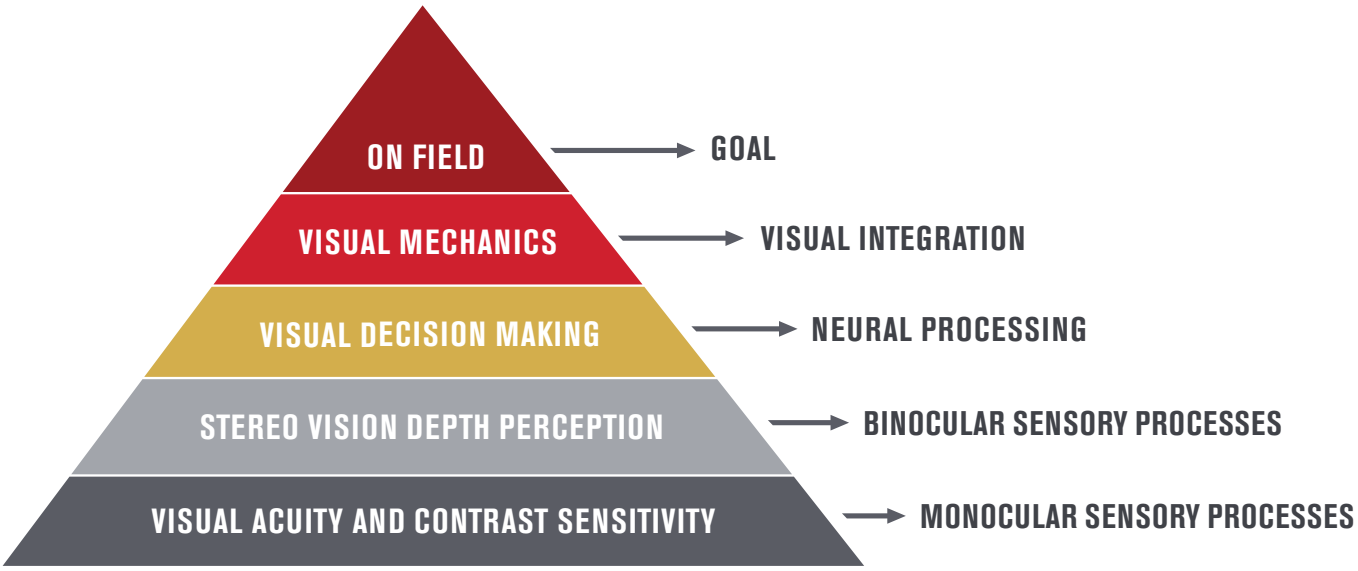


FIGURE COURTESY OF DAVID G. KIRSCHEN, DD, PHD; AND DANIEL M. LABY, MD

WHAT ARE THE TRAINABLE VISUAL COMPONENTS?

VISUAL HARDWARE (VISUAL PHYSIOLOGY)

- Static Visual Acuity (Visual Clarity)
- Contrast Sensitivity
- Depth Perception
- Dynamic Visual Acuity (Target Capture)
- Visual Accommodation and Vergence (Near-Far Quickness)

VISUAL SOFTWARE (PERCEPTUAL-COGNITIVE ABILITIES)

- (Visual Motor Control):
- Perception Span
- Multiple Object Tracking
- Eye-Hand Coordination
- Reaction Time
- Response Inhibition (Go/No-Go)

Visual hardware and visual software represent the two visual component categories. It is currently believed that most visual software components are more trainable than visual hardware. Individual component performance level should be assessed to help determine a fighter's sports vision training.

HOW DO I IMPLEMENT SPORTS VISION TRAINING FOR MMA?

Visual demands are dependent on the demands of the sport. Considering the demands of MMA and trainability of individual visual components, the following list of MMA visual training priorities has been developed that ranks the most to least important visual components to target for MMA:

MMA VISUAL TRAINING PRIORITIES

MOST RELEVANT/TRAINABLE → LEAST RELEVANT/TRAINABLE

GROUP 1	GROUP 2	GROUP 3
Reaction Time	Depth Perception	Target Capture (Dynamic Visual Acuity)
Go/No-Go	Multiple Object Tracking	Near/Far Quickness
Eye-Hand Coordination	Perception Span	Contrast Sensitivity
		Visual Clarity (Visual Acuity)

These components can be trained using analog or digital options. Examples of both options are provided in Figure 2. Digital and strobe glasses training has been shown to be most effective at improving visual performance.

EXAMPLE TRAINING OPTIONS

ANALOG	DIGITAL
Hart (Letter) Chart	Senaptec Sensory Station
Arrow Charts	NeuroTracker
Brock String	NeuroTrainer
Fusion Circle Cards	Vizual Edge
Near Far Chart	Reflexion
Stroboscopic Glasses	Binovi



WHAT ARE STROBE GLASSES?

Strobe glasses are a visual training tool that rapidly shifts from clear to blocked vision, challenging the athlete's visual system and requiring less reliance on visual feedback. They have been shown to improve anticipation, dynamic visual acuity, motion detection, central attention and short-term visual memory. Strobes also make for a good sport-specific tool for MMA, being that they can be used during technical training drills. This type of training is called naturalistic sports training.

SPORTS VISION TRAINING PROTOCOLS AND EXAMPLES

The table provides programming recommendations for sports vision training for both component skill and naturalistic sports training. Examples of naturalistic training using strobe glasses include:

- Five- to 10-minute dynamic warm-ups
- Technical drills, such as hitting mitts or bag work
- Footwork drills

SESSIONS/WEEK	# OF DRILLS/SESSION	DURATION OF EACH DRILL
2 TO 3	2 TO 4	4 TO 10 MINUTES

Each drill would be structured using the protocols in the table above and performed while wearing the strobe glasses. Caution should be taken when implementing strobes, especially as a warm-up. Excessive continuous use of strobes may lead to visual fatigue.


UFC
CENTURY
UFC
CENTURY



PART 3
SECTION 65



SECTION 65: MANAGING TRAINING AROUND INJURIES

By Heather Linden

It is common for fighters to have both acute and chronic injuries that need to be managed in fight-camp. Traditional approaches in MMA and other combat sports have been to "push" through injuries in order to get to fight night, however this can often lead to sub-standard performance and prolonged loss of time due to injury after the event. The risk of injuries negatively impacting a fight-camp can be minimized by recognizing and addressing physical limitations within the fighter's full technical and non-technical support team (e.g., physical therapist, sports medicine physician, technical coach(es), strength and conditioning coach). The fighter's full support team need to work in an inter-disciplinary fashion (See Section 13) and communicate closely to ensure that reasonable modifications are made to training that address any injuries and do not compromising well-being but still optimize the technical and tactical needs of the fighter prior to the fight.

This can be achieved through planning and adhering to a training schedule that optimizes training around an injury and enables adequate recovery between intense training sessions. Key factors in planning a training schedule designed to manage an injury in fight-camp include:

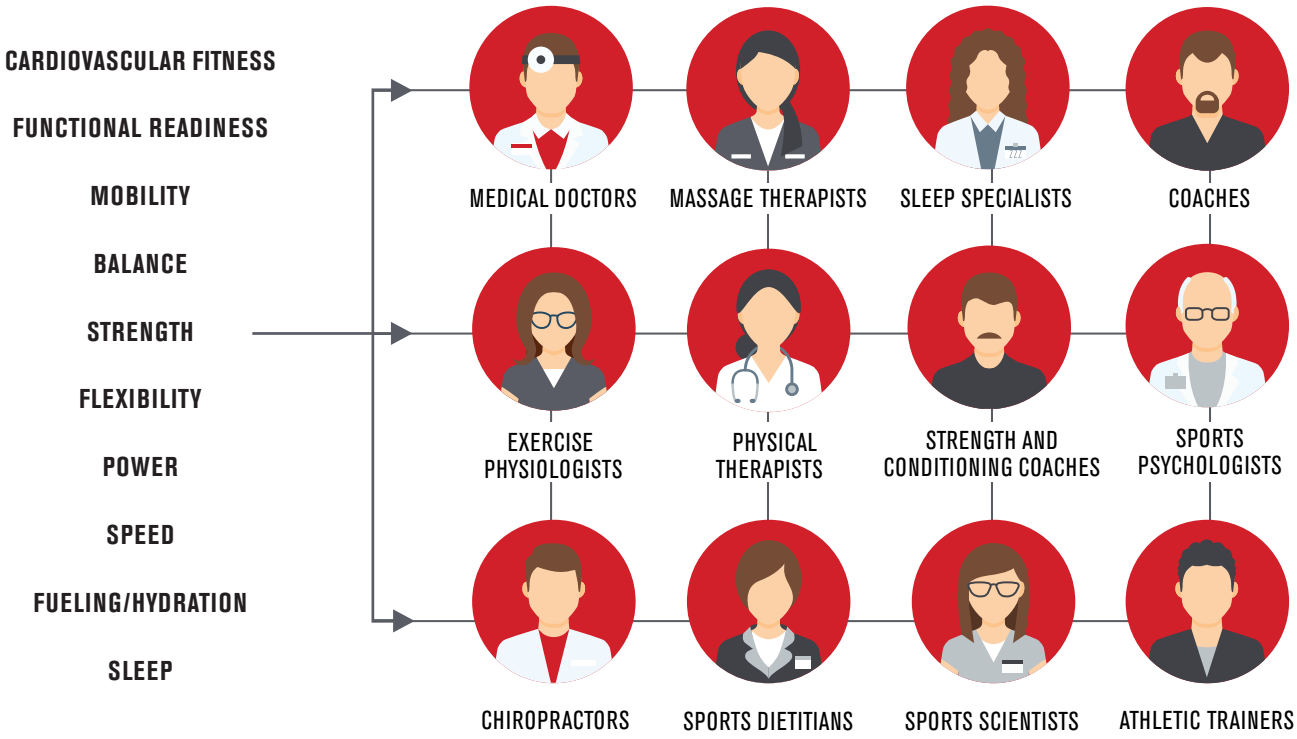
- Allowing time within the training schedule to get the treatment required to manage symptoms of the injury.
- Include remedial and corrective exercises in warm-ups and cool-downs for every session (See Section 40). These exercises should help to address any physical limitation impacting the injury and prepare the athlete for demands of training.
- Schedule recovery sessions (See Section 23). These sessions can take the form of passive recovery (e.g., Normatec, cryotherapy) or active recovery (e.g., light aerobic exercise) to assist with blood flow to the injured site and involves exercises for mobility, flexibility and neuromuscular control.

It should be noted that if one member of the fighter's support team is not on board with the overall strategy for the fighter who is carrying the injury, the risk of re-injury and poor performance significantly increases. An example of potential members of a fighter's support team that need to be involved in managing an injury in an inter-disciplinary manner are detailed in Figure 65.1.

Alongside appropriate planning and commonization

FIGURE 65.1

AN INTER-DISCIPLINARY APPROACH TO MANAGING INJURIES IN FIGHTERS



between the fighter's support team, measures to mitigate risk of re-injury and to let the injury heal should be taken in technical training. This can include protecting or supporting the injured area as needed with taping, bracing or padding. Other measures to mitigate risk of re-injury and to let the injury heal include reducing the intensity of technical training drills to enable the fighter to practice the desired tactic/skill without aggravating their symptoms. Ensuring the fighter has control within training situations and any drill has a predictable outcome (e.g., knowing a takedown will be attempted, and there will be the need to perform a defensive sprawl) are also important factors to avoid aggravating an injury. In the event that a technical training session may be too provocative for an injury, substituting that session with a different session that still achieves the same or similar goals—but has less negative impact on the injury—is recommended. For example, if a wrestling session aimed to improve glycolytic conditioning is unable to be performed without re-aggravating a lower-back injury, this could be exchanged for a glycolytic conditioning session on an air bike with similar work:rest ratios as the planned grappling session.

Lastly, the final two to four weeks of fight-camp often sees the highest percentage of acute injury incidence. Coaches should recognize this trend and appropriately plan training not only during the course of the last two to four weeks, but during the course of the whole fight-camp. Allowing for adequate recovery also needs to be prioritized by coaches when trying to manage injuries in fight-camp. Periodizing training over a meso-cycle (e.g., with a moderate-high-low weekly training cycle; See Section 15) will help to manage an injury in a fight-camp and reduce the risk of re-aggravating injury.


给你的训练供能
FUEL BAR SNACK COMPARISON 加油站零食对比
Snack per individual packet 单个包装
Energy (kcal) 热量（千卡）
Carbohydrate (g) 碳水（克）
Protein (g) 蛋白质（克）
Fat (g) 脂肪（克）
TAFF
SHANGHAI
上海



PART 3
SECTION 66

SECTION 66: FIGHT-CAMP FUELING STRATEGIES

By Clint Wattenberg

FUELING STRATEGIES TO SUPPORT METABOLISM, BODY COMPOSITION AND PERFORMANCE

Fueling priorities and strategies must adapt to each athlete's nutrition and weight-making demands. This section describes the variety of fueling strategies to support athletes through the full spectrum of these demands they may face in fight-camp.

METABOLIC REHABILITATION

Both acute and chronic calorie insufficiency cause varying degrees of metabolic impairment and downstream physiologic dysfunction. See Section 89 for an expanded look at metabolism and the metabolic rehabilitation fueling strategy.

ENERGY NEUTRAL FUELING STRATEGIES

Energy neutral (i.e., eucaloric) fueling strategies are nutrition interventions where weight change is not required, and they fuel an athlete with the calories required each day for basal and physical activity. How calories are balanced within meals and across the day can influence an athlete's physiologic and body composition adaptations.

BALANCED PLATE (ENERGY NEUTRAL)

Balanced-plate fueling provides structured nutritional timing without forcing individuals to tightly regulate the macronutrient content of a meal. This phase of fueling is often utilized off-camp but can also be used in cases in which weight descent does not require a reduction in specific nutrients—thus allowing more intuitive eating tactics to be implemented.

The purpose of balanced-plate fueling is to:

1. Reset overall energy substrate and macronutrient utilization with regards to digestion, absorption and utilization.
2. Provide basic, easy-to-follow structure for food selection to reduce mental strain and guide positive behavioral habits.

METABOLIC EFFICIENCY (ENERGY NEUTRAL)

Metabolic-efficiency fueling strategically delivers the preferred energy substrate to be used during the upcoming training session. The purpose of metabolic-efficiency fueling is to:

1. Improve energy-systems development from the physical training stimulus.
2. Stimulate fat oxidative pathways for energy stability and body composition improvements body composition improvements while preserving critical carbohydrate metabolism pathways.
3. Train the gut to improve tolerance during high intensity training to preferred energy substrates (e.g., carbohydrate) during training.

Metabolic-efficiency fueling targets the fuel source required for each specific training session in the meal and snack(s) immediately preceding that training session (e.g., in the four hours pre-training). As such, athletes can better target training adaptations with an energy-neutral, metabolic-efficiency strategy in periods during which weight descent is not a priority. For an example of the specific fuel sources prior to a session, athletes should generally fuel with carbohydrate energy sources before high-intensity training efforts and fat sources before low- and moderate-intensity training efforts. The cutoff for using carbohydrate vs fat sources depends on the athlete's individual physiology and weight-management demands, but this principle remains valuable regardless of individual variation.

WEIGHT-DESCENT FUELING STRATEGIES

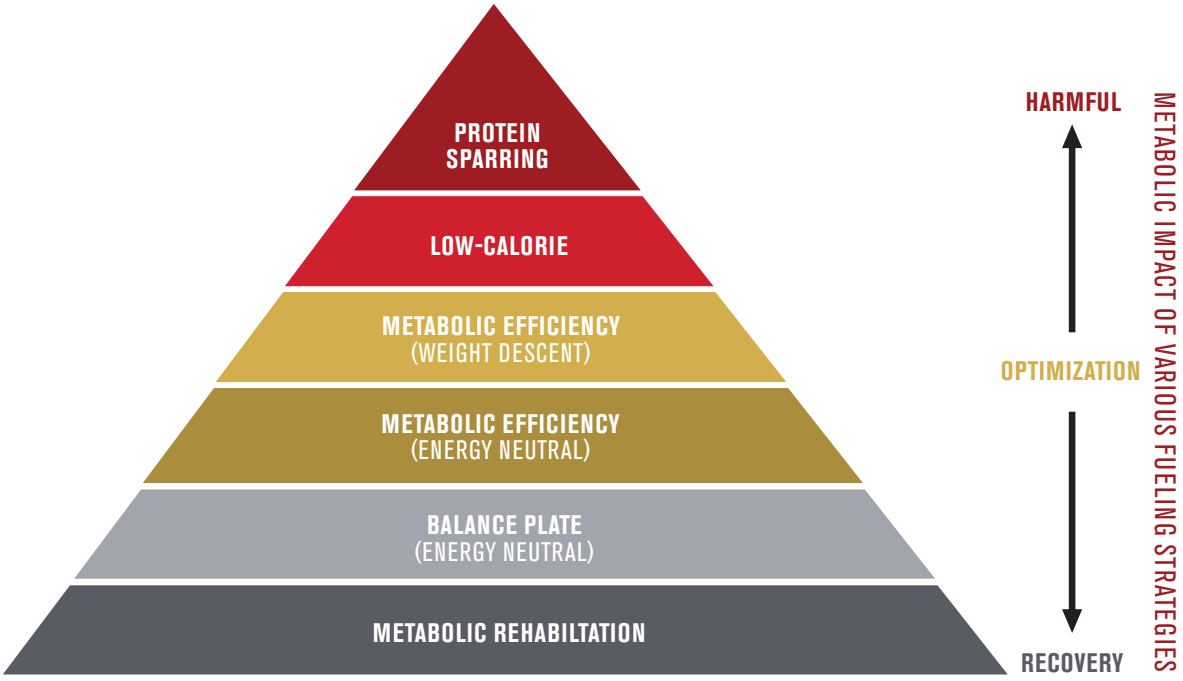
Establishing a timeline for a weight descent is vital in order to effectively navigate a fighter's down to ideal fight weight. This should occur over an adequate time period to ensure the weight loss happens gradually and without significant metabolic disturbance. The recommended target weight for UFC athletes to enter fight week is seven to eight percent above their weight division. For more details on weight-descent planning, see Section 35.

METABOLIC EFFICIENCY (WEIGHT DESCENT)

- Most preferred weight-descent option
- Ideal for 0.5 to 1% weight-loss per week
- Protein needs: 2.2 g/kg body weight

Similar to an energy-neutral, metabolic-efficiency strategy, a weight-descent metabolic efficiency fueling strategy supports both training adaptations and a moderate weight descent—along with recovery. This fueling tactic is ideal for moderate weight descents of 0.5 to 1 percent of body weight per week, typically equating to a 0.5-1.0 kilograms (or 1 to 2 pounds) of fat loss each week, which equates to a daily deficit of 500 to 1,000 calories. If weight loss does not respond with this moderate calorie deficit, the athlete's metabolism is most likely down-regulated, which may have consequences for long-term metabolic health. In these cases, a brief escalation of the fighter's nutrition strategy to "low calorie" or "protein sparing" (depending on a number of factors including the fighter's fat free mass to weight-division ratio) may be appropriate. This should be followed by metabolic rehabilitation at the completion of fight-camp to reverse any negative effects of under-fueling on metabolic health. Alternatively, if the risks of the more extensive energy deficit do not outweigh the rewards, then the athlete should consider finding a different fight opportunity that allows for a more achievable weight-making timeframe.

FIGURE 66.1
FOUNDATION OF FUELING STRATEGIES FOR METABOLIC HEALTH



LOW CALORIE (LOW CARB AND LOW FAT)

- Ideal for 1 to 1.5 percent weight loss per week or for plateaus with less severe weight descent tactics
- Protein needs: 2.2 to 2.5g/kg body weight

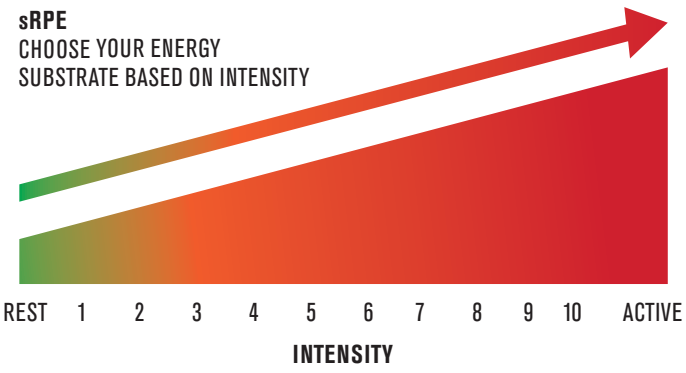
Low-calorie fueling eliminates the dedicated carbohydrate and fat sources prior to training sessions, forcing the body to increase the use of internal energy sources. Carbohydrate and fat consumption post-training is also limited and impairs physical recovery from training—which makes this an approach to only use in more demanding cases. The low-calorie fueling strategy should be limited to finite timeframes of one to four weeks so that recovery is not overly impaired and does not dramatically increase injury risk and metabolic dysfunction.

PROTEIN SPARING (LOW CALORIE AND SUB-LEUCINE THRESHOLD PROTEIN DOSING)

- Least preferred weight-descent option
- Likely required for >1.5 percent weight loss per week or for plateaus at less severe weight-descent tactics
- Protein Needs: 0.8 to 1.0 g/kg body weight, with each protein serving being spread across the day being < 2.5g leucine and <20g total protein

Protein-sparing fueling is the final and most extreme fueling option when athletes must strategically reduce their fat-free mass. This fueling strategy is both very low calorie (through eliminating carbohydrate and fat energy sources) and low protein, which limits the storage of protein as muscle. Protein doses must be <20 grams of complete protein or <2.5 grams of the amino acid leucine—which has a direct muscle anabolic effect. By keeping both protein and leucine "sub-threshold," athletes can fuel their bodies in a limited but targeted manner, allowing them to be as nourished as possible during this period of an aggressive energy deficit. The protein-sparing fueling strategy is very aggressive and should only be utilized in urgent cases for no longer than one to two weeks, if possible, and followed by a period of metabolic rehabilitation.

FIGURE 66.2
USING SESSION RATINGS OF PERCEIVED EXERTION TO DECIDE APPROPRIATE FUELING STRATEGIES







PART 3
SECTION 67

SECTION 67: MITIGATING HYPERTROPHY

By Bo Sandoval and Clint Wattenberg

Managing muscle mass and hypertrophy can be critical in weight-class sports like MMA, which athletes are striving to not only optimize body weight but also have a larger frame than their opponent (i.e., taller or with greater reach). Hypertrophy mitigation refers to the strategic use of specific nutrition and supplementation, strength and conditioning and recovery tactics to elicit improved performance, while avoiding muscle hypertrophy or even driving muscle atrophy. These tactics are described in more detail below, but especially in regard to strength and conditioning, mitigating hypertrophy can be very individual with some fighter's fat-free mass, regardless of sex, responding much more to resistance training than others. Therefore, the fighter's support team should first identify if resistance training is a priority for the fighter, and if so, what is an appropriate weekly frequency of resistance training is. This should be considered along with the fighter's nutritional scenario, including but not limited to estimated number of weeks until the fight, calorie deficit, technical training demands and energy reserve for calories burned from supplemental cardiovascular training. The fighter's support team also wants to ensure that the athlete is not being introduced to resistance training for the first time during fight-camp, especially when an aggressive weight-descent protocol is in place.

NUTRITIONAL AND SUPPLEMENTATION TACTICS

CALORIE DEFICIT

▪ Summary of Tactic: A moderate, targeted and sustained daily calorie deficit to reduce body weight while still supporting training and metabolic-health energy demands

▪ Proposed protocol: Limited 250-500 calorie deficit on total energy expenditure when 8+ weeks available to achieve hypertrophy mitigations adaptations. Greater calorie deficits may be required with less time available but will result in elevated tissue breakdown and metabolic impairment.

DAILY PROTEIN INTAKE

▪ Summary of Tactic: A moderate, targeted and sustained daily protein deficit to reduce lean body mass while still supporting tissue and recovery needs while also mitigating the negative consequences of any caloric deficit

▪ Proposed protocol: 0.8 to 1.2 g/kg per day of protein

PROTEIN TIMING & FREQUENCY

▪ Summary of Tactic: Small protein feedings across the day support tissue recovery, and when controlling for overall protein amount, the frequency of protein ingestion should not increase lean body mass. It may be important to limit the amino acid leucine across these feedings because of its effect on muscle protein synthesis

▪ Proposed protocol: 6 to 8 feedings of 5 to 15 grams per day with <2 gram per serving of leucine and/or <10 to 12 grams per serving essential amino acids

PLANT-BASED PROTEIN

▪ Summary of Tactic: Plant-based protein may be a better option for not eliciting muscle growth but still supporting recovery because of its lower EAA and leucine content, lower solubility and digestion kinetics. Managing carbohydrate content of plant-based food is also critical to provide optimal calorie and carbohydrate levels to support training demands as well as body composition adaptations.

▪ Protocol for Consideration: Consume a plant-based diet ensuring consistent protein within meals and snacks that contain low leucine content to limit muscle gain while still supporting recovery.

TIME-RESTRICTED EATING

▪ Summary of Tactic: Restricting calorie consumption to smaller windows of time can lower overall calorie consumption. It also appears that muscle-protein synthesis rates are lower in a fasted state which may help mitigate hypertrophy. This tactic should be limited to low- and moderate-volume/intensity training periods. Time-restricted eating tactics, including intermittent fasting, should be done by athletes with care, especially MMA athletes who have extensive recovery demands.

▪ Proposed protocol: Fasting should be timed around inactive or lower intensity training to avoid driving a catabolic muscular response, poor training outcomes or undesired training adaptation.

ACUTE ANTIOXIDANTS

▪ Summary of Tactic: Consuming antioxidants around training may mitigate any hypertrophy from training.

▪ Proposed protocol: 1000 to 2000mg (20,000-40,000 IU) of Vitamin C and 235mg (350 IU) of Vitamin E per day for 10 weeks. Half the amount is taken one to three hours before training, and the other half is taken in the hour after training.



STRENGTH AND CONDITIONING CONSIDERATIONS

AVOID HYPERTROPHY TRAINING

▪ Summary of Tactic: Avoid training singular or multiple muscle groups toward volitional fatigue (e.g., loss of form), as this can contribute to hypertrophy by expanding muscular cell volume and increasing appetite. Accessory work that does not directly contribute to the overall performance of the fighter or his or her injury-prevention strategy should also be limited for volume considerations.

▪ Proposed protocol: The majority of resistance training should be <8 reps, <4sets per exercise at 25-85 percent 1RM) with long rest periods >90 seconds.

AVOID HEAVY ECCENTRIC LOADING

▪ Summary of Tactic: The eccentric contraction occurs when a muscle is lengthening (e.g., lowering of a squat or deadlift), and removing the eccentric contraction from strength and power exercises can limit muscle soreness from heavy strength training—which is a key physiological driver of muscle hypertrophy.

▪ Proposed Protocol: Utilize explosive concentric (shortening of the muscle) exercises with little to no eccentric contraction (e.g., speed deadlift followed by dropping the bar or medicine ball shotput).

AVOID SLOW TEMPOS WHEN LIFTING

▪ Summary of Tactic: Another key driver of muscle hypertrophy is the time-under-tension (TUT) a muscle is placed under. Slow tempos when lifting, where the eccentric and concentric actions are manipulated by time (e.g., squatting with five-second eccentric and three-second concentric phases, will increase TUT.

▪ Proposed protocol: Fighters should focus on moving the resistance as rapidly as possible.

INCREASE CARDIOVASCULAR TRAINING

▪ Summary of Tactic: Adequate amounts of low-intensity cardiovascular training can suppress muscle hypertrophy (e.g., aerobic interference). Cardiovascular training should be coordinated with the nutrition strategy to contribute to the intended weekly calorie deficit during a fighter's weight descent.

▪ Proposed protocol: Use low biomechanical load cardiovascular activity (e.g., biking, swimming, elliptical and shadow boxing) to supplement a fighter's weight descent. Target modes and skills in which the athlete is competent. Cardiovascular training should be completed when the athlete is in a low glycogen state (e.g., first thing in the morning or post-sparring rounds) to promote fat oxidation. Duration and frequency of the cardiovascular training should be between 20 and 90 minutes, three to six sessions per week and normally around 55-65 percent of max heart rate.

RECOVERY TACTICS

COLD-WATER IMMERSION

▪ Summary of Tactic: Cold-water immersion has been shown to reduce both the acute and chronic hypertrophic response to resistance training while potentially not affecting strength response.

▪ Proposed protocol: Ten to 15 min cold water immersion at 10 degress Celsius or 50 degrees Fahrenheit as soon as possible after training—ideally within five to 10 minutes of completing the workout.


ASSAULTFITNESS



PART 3
SECTION 68

SECTION 68: MANAGING THE WEIGHT DESCENT

By Clint Wattenberg

The moment a UFC athlete formally or informally accepts a fight and moves into fight-camp, it becomes critical to objectively track the weight-descent process independent of body composition variables like fat-free mass/weight division (FFM/WtDiv) or the weight-making preparedness score (WMPS). It is recommended that fighters aim to arrive at fight-week as close as possible to 7-8% over the weight division limit for an efficient fight-week weight-making process (See Section 74) and optimal/near-optimal performance. The most appropriate variable in this case assesses the risk associated with an athlete's weight-making efforts during fight-camp and is represented by the Weight Making Risk Score (WMRS). The WMRS takes into account the percent amount of weight an athlete is over his or her upcoming weight limit and the percent weight loss per week required to get down to target weight. As such, the higher the WMRS is, the more likely the fighter will not make weight.

The WMRS should be tracked weekly through fight-camp to understand the risk for a fighter to miss weight as he or she progresses through fight-camp. Waking weights over a three-day moving average is ideal for establishing and tracking the WMRS, and more information on how the WMRS is calculated is detailed in Figure 68.1. As an example, a male lightweight athlete who is 13.5 percent overweight (i.e., 176 pounds or 80 kilograms) and is needing to lose 0.7 percent of body weight each week to be at target weight the week before weigh-in would have a WMRS of 0.99. The average WMRS over the complete men's and women's weight divisions are also provided in Figure 68.2. Similar to the UFC roster data on the WMPS in Figure 35.2, this data indicates that men's bantamweights and featherweights are the most at risk of not making weight in a fight-camp and/or have harder weight cuts.

As mentioned, the WMRS is invaluable for identifying the impending risk and challenge of an upcoming weight descent for a fighter. The UFC PI has a number of different weight-descent categories based on different WMRS which are detailed below:

Very Low Risk: WMRS <1 indicates that an athlete should be able to easily bring his or her weight down with minimal calorie restriction.

Manageable Risk: WMRS between 1-2 indicates a targeted calorie deficit is required in order to elicit the necessary weight loss during the remaining fight-camp. As this level of WMRS typically relates to a weight loss of 0.7 to 1.0 percent per week during an 8=eight-week fight-camp, fighters should still be well-fueled with nutrition tactics supporting training and recovery adaptations (including metabolic efficiency development). A manageable risk weight descent also allows athletes to be competitively sized when they step foot inside the Octagon on fight night.

Rising Risk: WMRS between 2-3 indicates either extended or more extreme calorie restriction is required depending upon the time available until the fight. This typically relates to a 1.0 to 1.3 percent weight loss per week for an eight-week fight-camp. After completing a rising risk weight descent, athletes should consider implementing metabolic rehabilitation strategies as a result of the level of calorie and macronutrient restriction required to make weight in these cases (See Section 89).

High Risk: WMRS >3 will necessitate very aggressive nutrition and calorie restriction tactics that will limit energy available to support training, recovery and metabolic health. These high-risk situations should be avoided, if possible, as these levels of

FIGURE 68.1
WEIGHT MAKING RISK SCORE (WMRS) BREAKDOWN

% WEIGHT LOSS PER WEEK x % OVERWEIGHT x 1000

The percentage weight loss each week required to be at target weight of ≤8% of max. weight (which is the

The percentage above the max. weight of the weight division

FIGURE 68.2
AVERAGE WEIGHT MAKING RISK SCORE BY UFC WEIGHT DIVISION

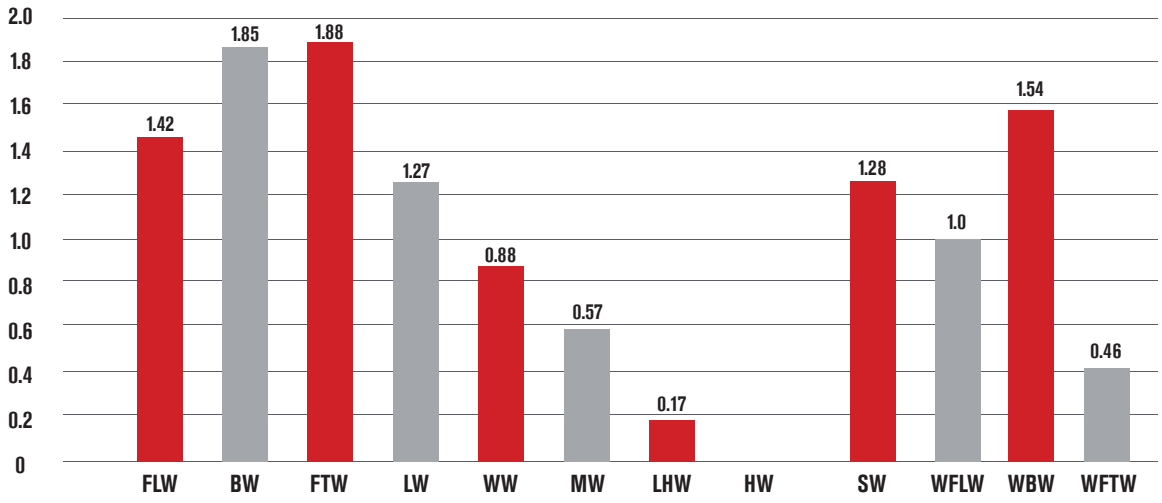


TABLE 68.1
DIFFERENT WEIGHT DESCENT EXAMPLES AND THEIR RISK OF NOT MAKING WEIGHT FOR 4- AND 8-WEEK FIGHT CAMPS

TOTAL % OVERWEIGHT	WEEKLY % LOSS	WEEKS UNTIL TARGET WEIGHT (T-1 WEEK)	WMRS	WMRS RATING
4-WEEK FIGHT-CAMP				
11%	0.8%	3	0.88	LOW
13%	1.3%	3	1.63	MANAGEABLE
15%	1.8%	3	2.63	RISING
18%	2.5%	3	4.50	HIGH
8-WEEK FIGHT-CAMP				
13%	0.6%	7	0.81	LOW
15%	1.0%	7	1.31	MANAGEABLE
18%	1.3%	7	2.25	RISING
20%	1.5%	7	3.00	HIGH

calorie and macronutrient restriction can cause metabolic dysfunction and impact current and future weight-making efforts, performance and health. Upon completion of an aggressive high-risk weight descent, athletes should engage in metabolic rehabilitation (See Section 89). Eight-week fight-camps requiring >1.3 percent weight loss per week qualify as high risk.

- Examples of different weight descent categories and their associated risk based on four- and eight-week fight-camps are detailed in Table 68.1 above.

FIGURE 68.3

AN EXAMPLE OF A REAL-WORLD SUCCESSFUL WEIGHT DESCENT OVER AN 8-WEEK FIGHT CAMP

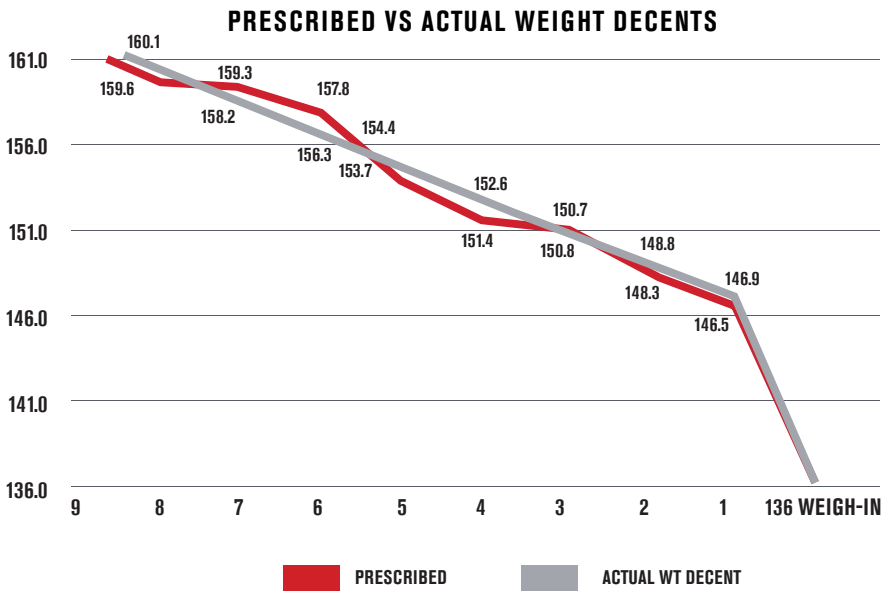


TABLE 68.2

AN EXAMPLE OF A REAL-WORLD WEIGHT DESCENT AND CHANGES IN NUTRITIONAL STRATEGY AND INTERVENTIONS BASED ON WEIGHT TRACKING OVER AN 8-WEEK FIGHT CAMP

WEEKS UNTIL WEIGH-IN	9	8	7	6	5	4	3	2	1	0
PRESCRIBED WEIGHT	162.0	160.1	158.2	156.3	154.4	152.6	150.7	148.8	146.9	136.0
ACTUAL WEIGHT	162.0	159.6	159.3	157.8	153.7	151.4	150.8	148.3	146.5	136.0
WEIGHT DEVIANCE	0.0	-0.5	1.1	1.4	-0.8	-1.2	0.2	-0.5	-0.4	0.0
% DEVIANCE	0.0	-0.3	0.7	0.9	-0.5	-0.8	0.1	-0.3	-0.3	0.0
% OVERWEIGHT	19.1	17.4	17.1	16.0	13.0	11.3	10.9	9.0	7.7	0.0
INTERPRETATION	ON-TRACK	ON-TRACK	BEHIND	BEHIND	ON-TRACK	AHEAD	ON-TRACK	ON-TRACK	ON-TRACK	ON-TRACK
NUTRITION STRATEGY	MET EFF – WT DESCENT	MET EFF – WT DESCENT	MET EFF – WT DESCENT	LOW CALORIE (LOW CARB/FAT)	MET EFF – WT DESCENT	MET EFF – WT DESCENT	MET EFF – WT MAINTAIN	MET EFF – WT DESCENT	MET EFF – WT DESCENT	FIGHT WEEK FUELING (LOW CARB + RESIDUE)

During a fight-camp, the fighter's weight descent and performance optimization are often competing priorities that must be strategically managed to elicit efficient weight-making and Octagon performance. Making weight becomes the dominant priority when athletes present with a higher WMRS because they may be unable to fight if they do not make weight. Figure 68.4 details appropriate weight-descent strategies for fighters based off their WMRS and risk categories. It should be noted that based on follow-ups with individual fighters, risk categories may be adjusted along with related nutritional strategies and interventions on a frequent basis. An example of a real-world weight descent and how nutritional strategies and interventions may change during the tracking of weight during the descent is detailed in Table 68.2 and Figure 68.3.

FIGURE 68.3

IDEAL WEIGHT DESCENT STRATEGIES FOR FIGHTERS BASED ON THEIR WEIGHT MAKING RISK SCORE (WMRS) AND RISK CATEGORIES DURING FIGHT-CAMP



GENERAL PREP: FFM/WTDIV | ANTI-HYPERTROPHY
SPECIFIC/FIGHT CAMP PREP: BODY COMPOSITION OPTIMIZATION TACTICS


THORNE®



PART 3
SECTION 69

SECTION 69: SUPPLEMENTS FOR COMPETITION

By Charles Stull

The use of dietary supplements varies among sports, as well as between competitive levels within a given sport (e.g., amateur vs professional). However, within combat sports, dietary supplement usage is a common practice. Therefore, an understanding of the functionality, risks, benefits and third-party testing standards of dietary supplements is important. The rationale for athletes to utilize nutritional supplements includes:

1. To correct or prevent micronutrient deficiencies because of the prolonged caloric deficits necessary for weight decent and weight making in combat athletes, generally poor nutrition practices or other clinical conditions (e.g., iron deficiency or anemia), see Section 34.
2. For the convenience of providing energy substrates and nutrients (e.g., protein or carbohydrate) around training sessions. This can be because of long duration of practices or a limited ability to tolerate meals prior to practice.
3. For a specific and direct performance benefit in competition/training, as well as recovery (e.g., creatine in order to influence energy availability).
4. The perception that other competitors are using supplements.
5. An athlete's historical use (i.e., tradition) which may sometimes be used despite inconclusive data supporting a supplement's ability to augment performance and/or recovery.
6. Financial gain from sponsorship deals or simply because products are provided free of charge.



GROUP 1: SPORTS FOODS

SPORTS DRINKS

Form: Ready-to-drink or powders normally have a carbohydrate concentration of five to eight percent (grams of carbohydrate/ml of fluid) with a sodium concentration of 10 to 35mmol/l (230mg to 800mg sodium per liter of fluid).

Function: Sports drinks are an efficient way to provide carbohydrate for muscle glycogen resynthesis and exogenous carbohydrate as a fuel substrate for training while replacing fluid and electrolyte losses from training.

ENERGY DRINKS

Form: Ready-to-drink, powders or concentrated shots containing a carbohydrate or artificial sweeteners and caffeine.

Function: Provide exogenous carbohydrates to meet training demands, and in some cases, caffeine for its numerous beneficial effects on athletic performance (See Athletic Performance Supplements below).

ELECTROLYTE REPLACEMENTS

Form: Powders or tablets containing on average 50 to 60mmol/L sodium (1150-1380mg sodium) as well as potassium, chloride and trace magnesium. Some electrolyte replacements also contain a low dose of carbohydrate two to four percent.

Function: Utilized for rapid rehydration following acute dehydration for weight making, endurance/ultra-endurance events, military combat deployment and other situations that require rapid rehydration after moderate-to-large fluid and electrolyte losses.

PROTEIN SUPPLEMENTS

Form: Ready-to-drink or powders containing 20 to 50 grams per serving of high bio-availability protein from animal sources, including whey, casein, egg, milk and from plant sources, including soy and blended plant proteins. Care should be taken to find a protein supplement of high quality, which includes having a complete amino acid profile, being high in leucine (>2 grams per serving) and third-party tested because of a high risk of contamination.

Function: Easily transportable and accessible post-training protein delivery to maximize muscle recovery and lean-body mass response to resistance training.

SPORTS BARS

Form: Bars typically containing 40 to 50 grams of carbohydrate per serving, 5 to 10 grams of protein and typically lower in fat and fiber. Note that within the combat sports population, lower carbohydrate sports bars are useful to provide a modest dose of carbohydrate to allow for a greater caloric deficit from training.

Function: Readily available and low volume pre-training snack.



GROUP 2: IMMUNE HEALTH

VITAMIN C

Overview: Vitamin C is an essential water-soluble antioxidant

Mechanism: Segregates reactive oxidant species and reduces inflammatory cytokine (e.g., interleukin-6) and cortisol responses to exercise.

Considerations: A moderate amount of evidence suggests that daily intake of 0.25-1g/d reduces incidence of upper respiratory tract infections (URTI). However, chronic intake may impair muscle adaptation in trained athletes, especially when taken at high doses immediately following training. Currently, no research supports vitamin C intake for treatment of URTI's, however it may reduce the risk of acquiring an URTI in athletes during intense training blocks.

VITAMIN D

Overview: Vitamin D is an essential fat-soluble vitamin. Exposure to sunlight accounts for 90 percent of vitamin D synthesis.

Mechanism: Vitamin D is involved in many aspects of immune function, including the expression of anti-microbial proteins.

Considerations: A deficiency of vitamin D is associated with increased URTI. There is also an increased risk of deficiency in athletes, especially those that have little exposure to sunlight or darker skin pigmentation. Recommend 5000 to10,000 IU/d for athletes with low sun exposure and/or during autumn/spring to maintain sufficient levels. Higher doses are indicated for those with an identified deficiency.

PROBIOTICS

Overview: Probiotics are orally ingested micro-organisms, which when taken consistently during the course of several weeks can increase the number of beneficial gut bacteria.

Mechanism: Probiotic supplements help modulate gut flora profiles which have been associated with gut health and immune function.

Considerations: Moderate support indicates probiotics can modulate gut health in athletes with doses of 1010 live bacteria per day. Studies have shown an approximate 50 percent reduction in URTI incidence as well as shortening of URTI length. Probiotic supplementation may have utility for reducing gastrointestinal distress and infection for traveling athletes.

GLUTAMINE

Overview: Glutamine is a non-essential amino acid that is utilized as a fuel substrate by an array of tissues, in particular immune and intestinal cells.

Mechanism: Glutamine suppresses pro-inflammatory signaling pathways and protects cells from apoptosis (i.e., cell death) during cellular stress, which then influences the effectiveness of mucosal and systemic immune responses.

Considerations: Reduction of URTI in endurance athletes receiving 5 grames glutamine twice per day may have utility for athlete populations at risk of exercise-induced gut inflammation from heat and mechanical stress.



ZINC

Overview: Zinc is an essential mineral commonly utilized for immune support.

Mechanism: Zinc is required in DNA synthesis and enzyme co-factors for immune cells.

Considerations: Zinc deficiency results in impaired immunity, though deficiency is hard to test for and uncommon among athletes. Research does not support zinc supplementation for preventing URTI, but it may reduce URTI duration when taken immediately after onset of URTI symptoms. High doses of zinc actually have contraindications for immune support and should be avoided. Zinc has been shown in some studies to reduce pains, cramps and the discomfort associated with menstrual cycle symptoms.

LYSINE

Overview: Lysine is a commonly used amino acid in the topical treatment of Herpes Simplex Virus (HSV).

Mechanism: Lysine competes with arginine for absorption and entry into cells. Lysine inhibits HSV growth and proliferation by keeping arginine out of cells.

Considerations: Oral lysine supplementation appears to be ineffective for the prevention or treatment of HSV lesions with less than 1gram per day without following a low-arginine diet. Doses of 3 grams per day appear to improve subjective self-reported symptoms.



GROUP 3: INFLAMMATION MANAGEMENT

OMEGA-3 FATTY ACIDS

Overview: Omega-3 fatty acids are found in fish oil and may augment immune function by regulating eicosanoid formation (e.g., prostaglandin, which is an immune suppressant).

Mechanism: They have immune-augmenting ability to reduce symptoms and enhance recovery from muscle damage (e.g., delayed onset muscle soreness, or DOMS).

Considerations: The quality of omega-3 supplements must be ensured because of its ease of oxidation (leading to conversion to peroxide). In addition, fish oil and omega-3 fatty acid supplement consumption could include heavy metal contaminants if quality control measures are not taken.

CURCUMIN

Overview: Curcumin is an anti-inflammatory compound found in the spice commonly known as turmeric.

Mechanism: Curcumin intake of (200mg per day) has been shown to reduce exercise induced DOMS. It is speculated curcumin intake improves total antioxidant capacity, markers of muscle damage and inflammatory markers. Significantly reduced subjective levels in pain have been reported by individuals taking curcumin.

Considerations: Potency, quality and bio-availability can vary greatly between different supplements. Therefore, it is important to find a third-party tested and verified product to minimize product adulteration risk. In addition, turmeric supplements have a much lower bio-availability than pure curcumin and require black pepper derivatives for better absorption.

TART CHERRY

Overview: Tart cherry juice at a dose of 250 to 350ml twice per day for four to five days before an athletic event and/or two to three days prior has been shown to promote recovery.

Mechanism: Reduces subjective perceptions of pain, as well as augmenting inflammatory cytokines and markers of muscle damage.

Considerations: Potential benefits may be sport/training/athlete-specific and more research is required to support its utility within combat sports. In addition, tart cherry juice is high in simple sugars which may impact an athlete's weight descent when taken at a therapeutic dose. Therefore, careful consideration should be taken before integrating it into an athlete's recovery methods.

GLUTATHIONE

Overview: Glutathione is an endogenous water-soluble antioxidant that regulates oxidative stress and immune function.

Mechanism: Glutathione is an essential co-factor for antioxidant enzymes and has a protective oxygen free-radical scavenging capacity for mitochondria.

Considerations: Though endogenous glutathione plays a critical role in anti-inflammatory capacity, limited research exists to validate oral glutathione's ability to augment glutathione status and markers of oxidative stress.



GROUP 4: INJURY STATUS

Targeted dietary supplementation can play a role in injury recovery. Details of injury recovery supplementation can be seen in Section 84.



GROUP 5: ATHLETIC PERFORMANCE

CAFFEINE

Overview: Caffeine is a stimulant with well-established benefits for endurance-based athletic performance, maximal bouts of exercise and repeat sprints.

Mechanism: Increases endorphin release and improves neuromuscular function, cognitive function and perception of fatigue

Protocol: 3 to 6mg/kg body mass of anhydrous caffeine, 60 minutes prior to exercise or <3mg/kg body mass co-ingested with carbohydrate source pre- and intra-training (i.e., during training).

Considerations: >9mg/kg does not appear to increase performance compared to lower doses but may increase risk of negative side effects. Because of individual genetic variances, baseline intake and individual response to caffeine, caffeine intake for training should be trailed prior to competition. Caffeine is a diuretic and promotes increased urine output.

BETA-ALANINE

Overview: Beta-alanine elevates intracellular buffering capacity, thereby increasing sustained high-intensity exercise performance. It is particularly effective for continuous or intermitted bouts of exercise (30 seconds to 10 minutes in duration).

Mechanism: It is a precursor to carnosine, which protects against hydrogen ion accumulation and excessive lactic acid accumulation.

Protocol: 65mg/kg/d, 0.8 to 1.6g every three to four hours during an extended time frame of 10 to 12 weeks (longer if possible).

Considerations: Negative side effects can include skin rash and paraesthesia (tingles). These side effects can exacerbate underlying skin conditions (e.g., herpes simplex virus symptoms). The tingling effect usually subsides within one to two weeks and is not thought to be harmful in the absence of concurrent skin conditions.



CREATINE

Overview: Creatine enhances the performance of repeated high-intensity bouts of exercise. It has positive chronic outcomes in resistance and interval training programs, indirectly leading to greater lean body mass, muscular strength and power.

Mechanism: Supplementation leads to greater intramuscular creatine stores which promote PCr resynthesis, and in turn allows for improved short-duration, high-intensity capacity.

Protocol: 20 grams per day in 3 to 5 gram doses for seven days (loading phase), followed by 3 to 5 grams per day everyday through supplementation period. Ideally, co-ingest with carbohydrate and protein for increased muscle uptake.

Considerations: Potential for water retention (1 to 2kg body mass) and gains in lean-body mass which may complicate weight-making and should be strategized before initiating a creatine regiment. A note for cutting weight is the water retention results from increased volume in the muscle cells and is not thought to inhibit water loss from other compartments.

NITRATES

Overview: Dietary nitrates have been historically used for prolonged submaximal exercise and high-intensity, intermediate and short-duration bouts of exercise.

Mechanism: Enhances plasma nitric oxide bio-availability, thereby increasing oxygen delivery to muscle tissue, enhances function of Type II fast-twitch muscle fibers, reduces ATP cost of muscle force production and increases mitochondrial efficiency.

Protocol: Consume high-nitrate foods including dark leafy greens and root vegetables (e.g., spinach, rocket, celery and beetroot). Acute bolus intake of 310 to 560mg nitrates two to three hours prior to exercise can be used, although prolonged intakes of more than three days appears to have a larger benefit for performance.

Considerations: Preliminary research shows that oral antiseptic mouthwash prevents the conversion of dietary nitrate to nitric oxide by killing off commensal oral bacteria.

SODIUM BICARBONATE

Overview: Sodium bicarbonate buffers extracellular pH, and thus has performance benefits on sustained high-intensity exercise.

Mechanism: Bicarbonate ions buffer extracellular pH balance; pH gradient allows for the efflux of hydrogen ions from exercising muscles.

Protocol:

- Acute Protocol: 0.2 to 0.4g/kg BM, 60 to150 minutes prior to event
- Split-Dose Protocol: 0.2 to 0.4g/kg BM split into equal doses spread through a 30- to180-minute window, finished 60 to150 minutes prior to event
- Serial Loading Protocol: 0.1 to 0.3g/kg per day (can be split doses) for five to 10 consecutive days prior to event.

Considerations: Given the high potential for GI distress, it's important to trial individual tolerance and strategies prior to use in competition.



GROUP 6: CONCUSSION AND BRAIN INJURY

An array of dietary supplements, when taken in conjunction with progressive physical therapy, dietary interventions and a well formulated strength and conditioning progression, may aid in recovery from traumatic brain injury. Details on these supplementation strategies can be found in Section 85.



GROUP 7: SLEEP AND RECOVERY

An array of dietary supplements has shown the ability to augment sleep and recovery patterns. Strategies for when and how to implement these strategies are detailed in Section 72.

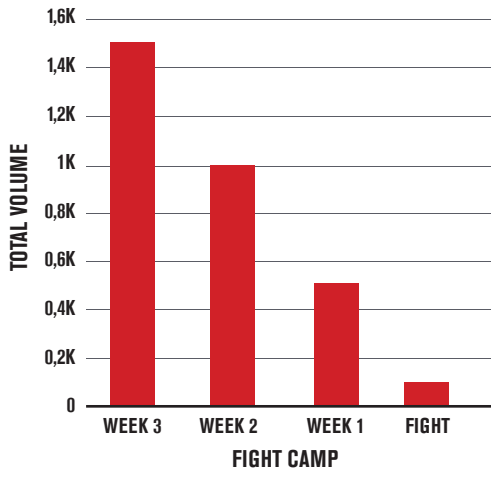




PART 3
SECTION 70

SECTION 70: TAPERING AND PEAKING FOR COMPETITION

By Matthew Crawley, Dean Amasinger, and Felix Falkenberg

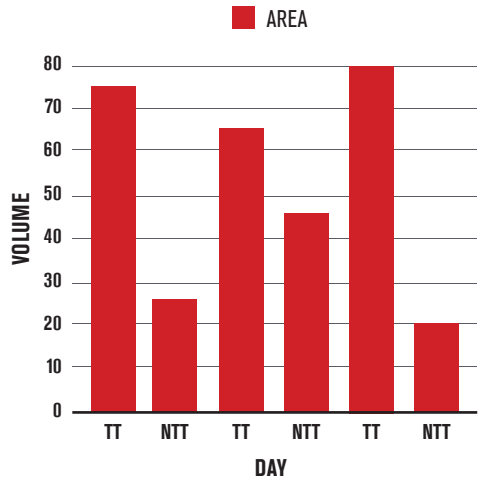


	A	B
1		UNITS
2	WEEK 3	1500
3	WEEK 2	1000
4	WEEK 1	500
5	FIGHT	100

WHY DELOAD?

Allow the body to rest physically and mentally

Allow adaptations to peak in time for competition



	A	B
1		AREA
2	TT	75
3	NTT	25
4	TT	65
5	NTT	45
6	TT	80
7	NTT	20

WHAT DOES A TAPER LOOK LIKE?

Decrease total volume of reps, sets and duration

Maintain intensity and frequency

Magnitude and duration of taper may differ between fighters

MMA COACH TIPS

- Adjust training session structure based on fighter's subjective and objective readiness measures.
- Use technical warm-ups for short anaerobic efforts to stimulate nervous system (e.g., 1: 5 x 10 seconds on, 50 seconds off with power strikes).
- Perform a priming session (15 to 30 minutes, low-volume, high-quality reps with long rest periods) four to seven days before competition.

APPROACH
(SIX TO 14 DAYS OUT)

TECHNICAL TRAINING: Decrease total volume and number of live rounds, maintain intensity with sharp focus and positive attitude in training, individualize tactical drilling and situational sparring with fighters' area of strength, and make minor technical adjustments if needed.

NON-TECHNICAL TRAINING: Decrease sets, repetitions and frequency, but maintain intensity.

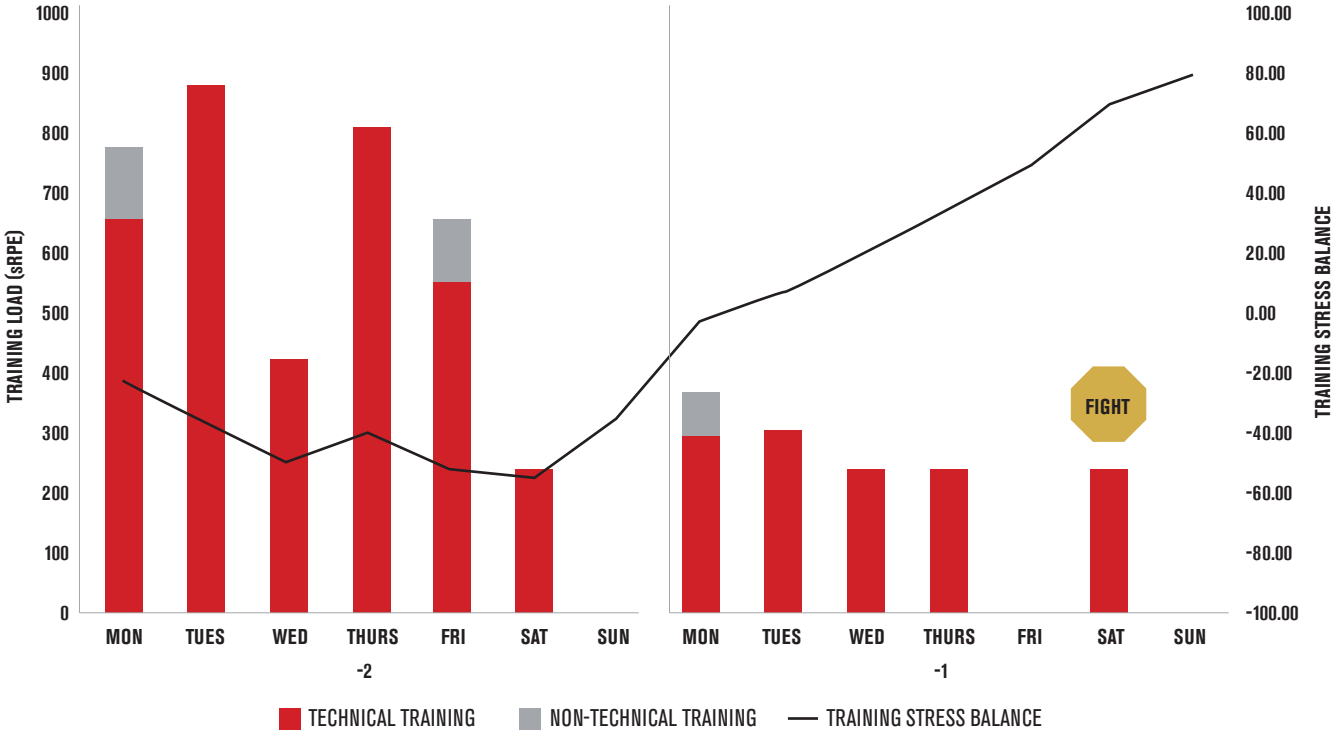
NUTRITION: Individual weight-descent protocol and hydration support.

PHYSICAL THERAPY: Acute injury management, "feel good flushes."

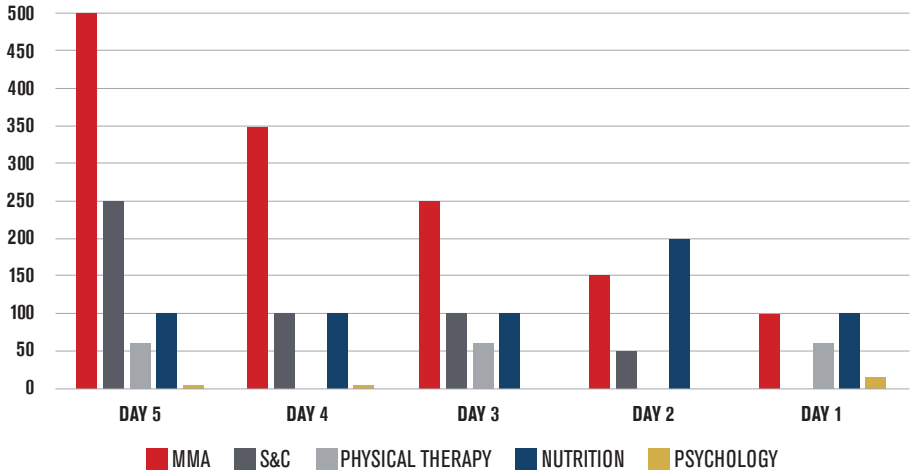
SPORTS SCIENCE: Monitor subjective (e.g., psychometric SRSS) and objective (e.g., HRV) readiness variables, encourage eight to 10 hours sleep and use of recovery modalities.

SPORTS PSYCHOLOGY: Use targeted mental skills (e.g., positive reinforcement and self-talk), and progressively increase emphasis on mental preparation as fight approaches.

14-DAY TAPER LOAD DISTRIBUTION



EXAMPLE DISTRIBUTION OF A 5-DAY TAPER



KEY POINTS

- Deload to get your mind right, locked in and ready for competition.
- Reduce training volume by 40 to 60 percent.
- Use moderate-to-high training intensities.
- Maintain training frequency of approximately 80 percent of pre-taper.
- Deload and peaking programs should be individualized to fighter.





PART 3
SECTION 71

SECTION 71: HANDLING COMMON FIGHT-CAMP MEDICAL ISSUES

By Robert Gaisford





INFECTIOUS DISEASE (E.G., STAPH INFECTION)

SPORTS MEDICINE

- Identify issue.
- Start appropriate plan of action to mitigate infection.
- Inform medical physician.
- Facilitate contact with physician for appropriate visit and care of issue.

NUTRITION

- Provide supplements to mitigate infection.
- Alter nutrition for weight descent, if needed.

STRENGTH AND CONDITIONING

- Alter training volume due to limitations of infection.

MMA TECHNICAL COACHES

- Be vigilant in spotting infections and referring for medical advice.
- Control participation in practice based on sports medicine recommendations to minimize transfer and cross-infection.
- Ensure gym surfaces and shared equipment are cleaned properly multiple times each day.

ILLNESS (E.G., UPPER-RESPIRATORY TRACT INFECTION, GASTRO-INTESTINAL INFECTION)

SPORTS MEDICINE

- Identify symptoms and issues.
- Manage symptoms as possible.
- Relay information to medical, nutrition and strength and conditioning staff.
- Seek possible referral for further medical attention.

NUTRITION

- Supplement support.
- Diet modifications to support weight descent and altered training volume.

SPORTS SCIENCE

- Blood panel work up.

MMA TECHNICAL COACHES

- Identify athletes with symptoms and/or illness characteristics.
- Refer to a sports medicine/medical professional.
- Moderate practice volume upon return from illness.

KEYS TO HANDLING COMMON FIGHT-CAMP ISSUES

COMMUNICATION across all departments and all levels

- Formal: Weekly check-ins on progress led by department with biggest concern for fighter (e.g. acute injury: sports medicine and nutritionists lead to combat injury via physical and supplement modalities)
- Informal: Daily check-ins managing fluctuations of issue

RELATIONSHIP WITH ATHLETE

- Good relationship allows lines of communication to stay open.
- Trust from both athlete and staff is essential.
  - The athlete knows the practitioner is steering him or her in the right direction.
  - The staff knows the athlete is not keeping anything that may be impacting the issue from them.





CHRONIC INJURY

SPORTS MEDICINE

- Evaluate injury (e.g., orthopaedic and functional movement screening).
- Isokinetic strength testing to identify imbalances (e.g., Biodex).
- Manual therapy techniques to address soft tissue and joint issues.
- Physical therapy exercises to address imbalances and/or improper mechanics.
- Home-exercise program for continued remote support.

NUTRITION

- Supplement support for chronic injuries (e.g., gelatin, curcumin, Omega-3).

STRENGTH AND CONDITIONING

- Provide program that targets specific imbalances and weaknesses.
- Alter programs to avoid exercises that exacerbate symptoms.

SPORTS PSYCHOLOGY

- Identify issues related to anxiety around injury or returning to sport.
- Provide tactics to address issues.

MMA TECHNICAL COACHES

- Discuss tactical training skills that may be limited by injury.
- Identify possible modifications to weekly skills.
- Work with sports medicine and strength and conditioning to address biomechanics and weakness of MMA skills.

ACUTE INJURY WITHIN FIGHT-CAMP

SPORTS MEDICINE

- Identify issue.
- Start appropriate plan of action to mitigate.
- Consult fighter and support team about further diagnostics (e.g., x-ray, MRI).
- Manage issue with treatment and recovery modalities.

NUTRITION

- Provide supplements to reduce inflammation and aid with acute injury.
- Alter nutrition for weight descent.

STRENGTH AND CONDITIONING

- Alter training volume due to limitations of injury while still facilitating weight decent.
- Alter training modalities to limit stress to injured body part.

SPORTS PSYCHOLOGY

- Manage athlete around performance and injury anxiety.
- Implement visualization techniques.

MMA TECHNICAL COACHES

- Initial response to injury: Knowing basic injury management skills/first aid are important
- When to keep athlete stationary vs moving them
- Knowing when calling 911 is appropriate
- Discuss with sports medicine professional on return-to-sport plan to understand modification(s) that can be made to maximize training under limitations.
- Provide feedback for sports medicine to keep athlete honest and keep the rehab “environment” optimal.



PART 3
SECTION 72

SLEEP HYGIENE

By Charles Stull, Roman Fomin and Micah Schurnstein

Sleep is a key component that fighters should be incorporating into their lifestyle to increase performance. This crucial activity can sometimes be difficult to do and having good sleep hygiene is essential to getting the most out of sleep. One of the most important facets of sleep hygiene is having a routine. Sleep hygiene can also be improved by looking at different areas of a fighter's life including nutrition, neurology, behavior and mental health. Below are suggestions that can be used by fighters to improve their sleep hygiene and to ensure their routine gives them the best opportunity to obtain quality sleep.

SPORT SCIENCE

Create a balance between work (e.g., training, business, lifestyle) and recovery.

Attempt to manage your physical, psychological, and emotional stress during a day.

Make sure to get sufficient recovery after training. This should be customized to the fighter. Relaxing hydrotherapy, aromatherapy and soft tissue massage are recommended.

Dim lights and disconnect from all electronics and bright screens one hour before bed. Consider using blue-light-blocking devices (e.g., glasses) or night light settings with your devices.

Practice napping for 20 to 60 min during a day (optimally between 1 and 3 p.m.), especially if you have two training sessions in a day.

However, avoid napping later or for longer periods of time, (especially if you have trouble sleeping at night) and stay active during the day.

In most cases, avoid late training sessions right before bed unless required for competition acclimation.

Avoid lying in bed awake for long periods of time.

MENTAL HEALTH / BEHAVIORAL

Create a bedtime routine that helps your body relax and prepare for sleep (e.g., reading, shower, stretching, mindfulness)

Create a consistent time to fall asleep and to wake up.

Use your bed for only sleep and sex.

Create a positive sleep environment (e.g., dark room, quiet, temperature between 17 and 20 degrees Celsius, comfortable sheets and pillows).

Avoid drinking liquids late at night, so you do not awaken to use the bathroom during the night.

Consistently practice relaxation and mindfulness techniques to support being present with the act of sleeping and to quiet the mind before bed (e.g., body scans, visualization, progressive muscle relaxation, mindful breathing).

Use sleep/mindfulness applications that can help practice relaxation and mindfulness techniques correctly before bed.

NUTRITION

If electrolyte status is affecting sleep (e.g., water retention before sleep is poor causing frequent sleep disruption), electrolyte intake should be increased in training, and a pre-sleep electrolyte beverage high in sodium (250 to 500mg) should be consumed, especially if sleep disruption is because of a need to urinate.

As caffeine has a half-life of approximately 3 to 10 hours for different individuals, avoid caffeine intake after 4 p.m. to minimize sleep disruption. If still an issue, limit caffeine intake to before noon.

There are a number of key nutrients that can promote sleep in fighters. These include vitamin B (e.g., leafy greens, salmon, eggs, organ meats), tryptophan (e.g., pumpkin seeds, turkey, tart cherry) and magnesium (e.g., dark leafy greens, seeds, fish, nuts, avocados). If diet does not contain adequate amounts of these nutrients, or if training loads are high, consider proactive supplementation (e.g., vitamin B complex, tart cherry juice extracts, magnesium).

Supplements that aid with improving sleep latency can also be used when needed. These include parasympathetic activators like GABA (100 mg 30 minutes before sleep) and ashwaganda (500 to 600mg twice a day) or melatonin (3 to 12mg before sleep).



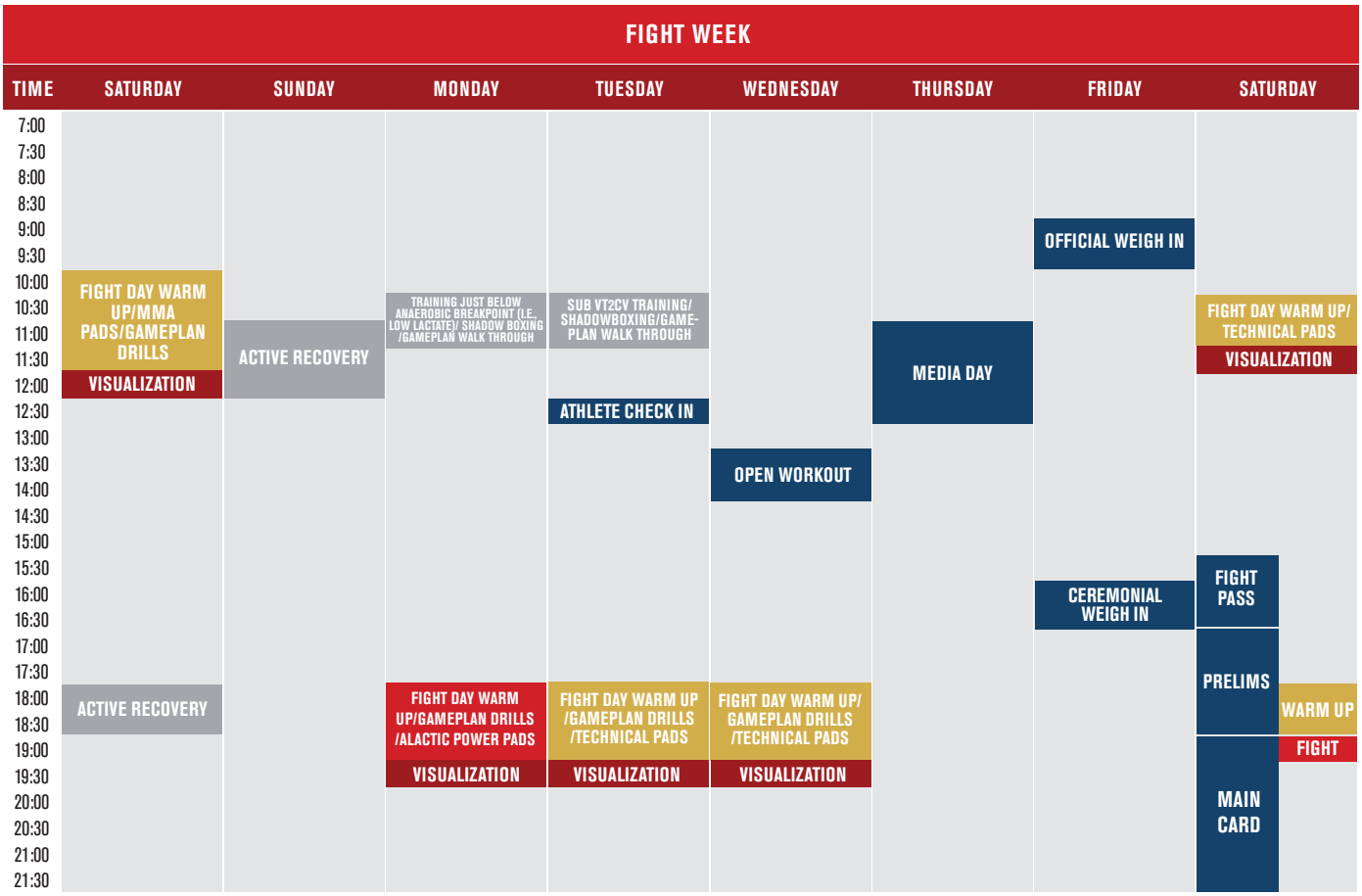
PART 4

FIGHT WEEK & COMPETITION

SECTION 73: OPTIMIZING PERFORMANCE: FIGHT-WEEK STRUCTURE

By Dean Amasinger, Richy Walsh and Forrest Griffin

FIGURE 73.1
A SAMPLE FIGHT-WEEK FOR AN ATHLETE FIGHTING ON THE FIRST BOUT OF A UFC EVENT'S MAIN CARD



There are a number of factors that play into the decision making around the intensity, frequency, duration and types of sessions used in fight-week. These can include how much weight a fighter will need to cut, injury risk, anxiety/nerves and personal preferences. There should also be a shift in emphasis during this week from developing physical or technical qualities to preparing psychologically for the fight. As fight-week is also part of the taper for a fight, this will mean the training frequency, intensity and duration should be much reduced in fight-week. It is critical to find the balance between the athlete feeling psychologically ready (e.g., "I have done enough training to be ready to fight") but not so much as to negatively impact performance in the fight. This can be based on the fighter's training and competition history and his or her preferences. From this history, coaches can adjust training session frequency, intensity, work-to-rest ratios and volume accordingly. A reduction of training intensity and volume may also be mandated by any calorie restriction in the weight cut—even in a well-managed scenario. The calorie restriction can often leave the athlete feeling "flat" with low energy throughout the week and on fight-day. Figure 73.1 shows a possible fight-week for an athlete fighting on the first bout of a UFC event's main card, who isn't traveling and is within 8 percent of target weight.



COACHES TALK

The fight day morning training session is optional depending on the fighter. As with several decisions related to fight-week, the athlete should trial a morning training session on the day of a fight to see how they respond. This workout is an opportunity to get the "blood flowing" and to "loosen up" while also working through anxiety and nervous energy while counteracting "feeling flat" or "heavy" from the weight cut.

During fight-week, the main training session each day should be held around the anticipated fight time. Ideally, training session times have been progressively altered during the fight-camp (due to time zones, if needed), so this is not a big change for the fighter during fight-week. This should be combined with establishing consistent sleep and wake times based around the competition time. This is important because of the relationship between the circadian rhythm and optimal hormonal levels (e.g., testosterone). These considerations become even more important for fighters traveling through time zones (See Section 75). It is also important in training to maintain any physical qualities that are needed for the fight, specifically conditioning and speed-power. The fighter will normally be able to maintain his or her conditioning with the low-intensity cardiovascular work normally used for weight cutting during fight-week. Meanwhile, a "micro-dose" of speed-power work within five to seven days of the fight can be used to maintain this quality. One way of doing this is by having the fighter complete a short high-intensity session focusing on the alactic energy system. An example of this could be a boxing or kickboxing pad workout (e.g., "power pads") focusing on maximal force production with approximately 10 seconds of explosive work and 90-plus seconds of rest. The rest period can be active with a focus on head movement and footwork.

Injury prevention is always a consideration in any fight preparation but in fight-week, it is very important to consider. During fight-week, the risk-to-reward ratio with high-intensity training sessions and live goes/sparring is not justified in almost all circumstances. Additional precautions, such as training partners wearing full protective gear to reduce cuts and touch sparring as the only live work, are also recommended. Preventing injury should also be considered with any additional cardiovascular work a fighter may use for a weight cut during fight-week. Choosing training modes in which the athlete is familiar and that have a low mechanical load (e.g.. "off-feet") is preferred and should reduce the risk of injury and muscle soreness. For example, if running has not been a part of the training during fight-camp, then it could be problematic to introduce it so close to the fight. Other considerations during fight-week include the athlete also having media obligations (e.g., phone interviews, the open workout, media day and of course, traveling to the fight location. This is a necessary part of the fight business, and coaches should be aware of the fatigue it may have on an athlete and manage this as best as possible. Relaxation techniques (e.g., breathing and visualization) can also be useful around these media obligations, especially if the athlete views these obligations negatively, finds them draining or if there are heated exchanges with opponents. For travel consideration, see Sections 75-77.

Lastly, the review process post-fight is the perfect opportunity to reflect on how fight-week preparation had just gone and evaluate what worked well and what could be improved upon. For these reasons, the structure of fight-week can vary from fighter to fighter considerably based on these reviews. By the time a fighter makes it to UFC, the athlete and coaching staff will hopefully have honed the fight-week structure which will help build familiarity, confidence and belief for the athlete.



PART 4
SECTION 74

SECTION 74: WEIGHT CUTTING AND FIGHT-WEEK FUELING

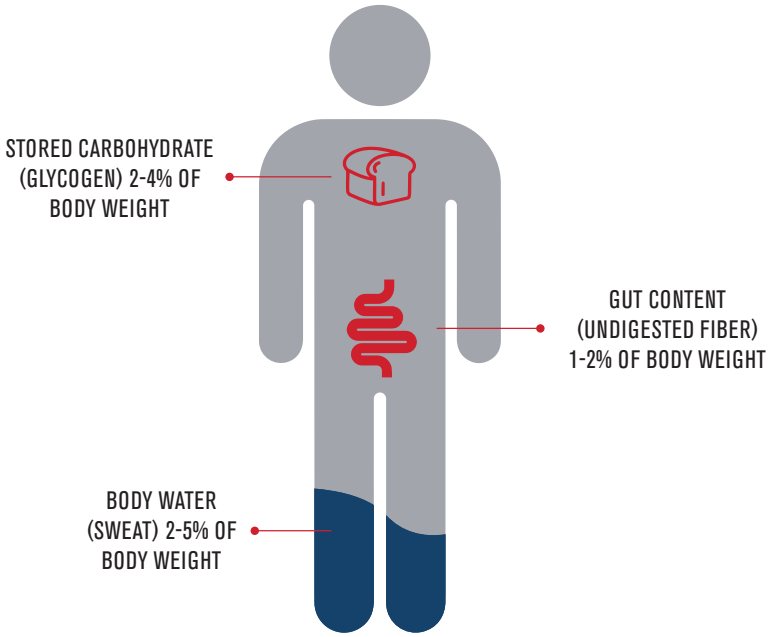
By Reid Reale and Charles Stull

When it comes to making weight, it's useful to think of weight loss as either chronic (long-term) or acute (short-term). Chronic weight loss produces "real" changes in body composition (i.e., changes in body fat and lean body mass. See Table 74.1). In comparison, acute weight loss results from brief shifts in body weight from other compartments, including changes in gut content, stored glycogen in the muscle and liver and overall total body water. Promoting body fat loss during a weight descent (i.e., chronic weight loss) has been covered earlier (See Sections 35 and 68), so this section will cover acute weight loss, or actual weight cutting, which is of particular interest to fighters.

TABLE 74.1
CHRONIC AND ACUTE WEIGHT LOSS

LONG TERM (WEEKS TO MONTHS)	SHORT TERM (HOURS TO DAYS)
BODY FAT	FLUID
MUSCLE	GUT CONTENT
	MUSCLE GLYCOGEN

FIGURE 74.1
THE THREE COMPARTMENTS OF "NON-ESSENTIAL BODY MASS"



NON-ESSENTIAL BODY MASS DEPLETION: THE THREE COMPARTMENTS

The three compartments of "non-essential" weight targeted during a weight cut are gut content, stored glycogen and body water (Figure 74.1). When done sensibly, reductions of these compartments will not significantly impact the health and performance of the fighter. In fact, a 10 percent reduction in body weight through weight cutting is relatively straightforward and safe. This 10 percent will generally be made up of losses in gut content (1 to 2 percent), stored glycogen loss (2 to 4 percent) and the remaining (4 to 6 percent) achieved via water loss. This is all provided that the athlete is well hydrated, routinely eats adequate fiber (≥25g daily) and supports their training with a reasonable amount of carbohydrates (≥5g per kg daily). On the other hand, a fighter who has already depleted carbohydrate stores through training and hasn't eaten fiber for several days will struggle to achieve a 10 percent body weight loss. In this case, the vast majority of weight loss is going to have to come from dehydration alone, which can be dangerous and severely impact performance. It should also be mentioned that because of various physiological factors and from UFC PI experience, weight cutting may be slightly harder for women. Women fighters should budget to cut slightly less than 10 percent in fight weeks (e.g., approximately 8 to 9 percent).

I: MANIPULATION OF GLYCOGEN CONTENT

Carbohydrate is crucially important for high-intensity exercise performance and is stored as glycogen in the body in two main compartments: i) skeletal muscle and ii) the liver. Muscle glycogen is the larger reservoir (potentially up to 1000g for some) with the liver accounting for substantially less (100 to 120g). Stored glycogen in the muscle is used to fuel moderate- to high-intensity exercise (such as MMA training), whereas glycogen in the liver maintains blood glucose levels at rest and contributes much less to exercise fuel demands. Glycogen storage and breakdown is primarily driven by diet (i.e., carbohydrate intake) and the volume and type of exercise. One key consideration is dietary carbohydrate stored as glycogen binds to water at a ratio of approximately 1 to 3. For example, 500g of stored carbohydrate will contribute almost 2kg to body weight (i.e., 500g as muscle glycogen and approximately 1500g of water.)

LOW CARBOHYDRATE DIET

BREAKFAST



EGGS & VEGETABLES

MID MORNING



GREEK YOGURT

LUNCH



CHICKEN & SALAD

AFTERNOON



PROTEIN SHAKE & WATER

DINNER



MEAT & VEGETABLES

Eating fewer carbohydrates while training volume remains constant—or maintaining your usual carbohydrate intake when increasing training volume—will result in lowered glycogen stores. Another key consideration for fighters trying to make weight is, as they should be tapering to peak for a fight in the days/week(s) before weigh-in, it is likely more beneficial to fight performance to eat fewer carbohydrates than trying to "burn it off" through additional exercise. The exact carbohydrate intake reduction required for each individual will vary, but a good guideline is to eat <50 g/d for three to seven days. For fighters who consistently eat a lot of carbohydrates, it may take seven days to fully deplete glycogen stores when tapering. However, three days may be enough to fully deplete glycogen stores for fighters who are already in a weight descent and/or have previously reduced carbohydrate intake.

II: MANIPULATION OF GUT CONTENT

Our gut is responsible for breaking down food and fluids to absorb nutrients. Some foods take longer to digest and pass through the digestive system than others. At any given time, the gut is likely processing food from the previous 24 to 72 hours. Gut content, including dietary fiber, binds water to make stools which constitutes a portion of body weight. Therefore, reducing fiber intake and total food volume will allow what is currently in the gut to pass and empty. The emptying will lead to a noticeable weight loss on the scales; normally around 1 to 2 percent of weight. The advantage of reducing fiber intake over complete fasting or laxative use is that a fighter can still consume adequate energy (calories) and protein to support recovery and general health. Consuming a low-fiber diet for just two days begins emptying the bowel with continued small losses for another one to two days. Therefore, a maximum of a four-day low-fiber diet is recommended prior to weigh-in for fighters. It should be mentioned that fibrous foods take the longest to pass through the gut—longer than non-fibrous foods, such as meats. However, a commonly held belief is that meats, and particularly red meats, take significant time to pass. There is no scientific evidence to support this; however many fighters choose to select white meats and fish instead of red meats in the days prior to weigh-in.

LOW FIBER & LOW CARBOHYDRATE DIET

BREAKFAST



EGGS

MID MORNING



GREEK YOGURT

LUNCH



CHICKEN WITH HIGH FAT AVOCADO & CREAM SAUCE

AFTERNOON



PROTEIN BALLS MADE WITH PEANUT BUTTER & PROTEIN POWDER

DINNER



MEAT WITH HIGH FAT PEANUT SAUCE

III: MANIPULATION OF BODY WATER

In the general population, water makes up approximately 60 percent of the human body by weight. This can be much more in fighters because of greater amounts of fat-free (or lean) mass. It is no surprise that many fighters use dehydration as a main method of cutting weight. However, not all dehydration is equal, and the risk to performance and health increases with larger amounts of dehydration. In a single training session, a fighter may lose two to three percent of body weight in sweat, so this amount is clearly not dangerous to health. Pushing this amount to four to five percent is a reasonable amount in a weight cut, but beyond this, dehydration becomes difficult and dangerous. The World Health Organization details 10 percent dehydration to be "life threatening." Cutting weight using dehydration can be achieved by either manipulating fluid intake (e.g., drinking less fluid) and/or expelling more fluid.

TABLE 74.2
WATER-LOADING PROTOCOL

-4 DAYS	100ML/KG FLUID TOTAL 7.7 LITERS FOR 77KG ATHLETE (2 GALLONS FOR 170 LBS)
-3 DAYS	100ML/KG FLUID TOTAL 7.7 LITERS FOR 77KG ATHLETE (2 GALLONS FOR 170 LBS)
-2 DAYS	100ML/KG FLUID TOTAL 7.7 LITERS FOR 77KG ATHLETE (2 GALLONS FOR 170 LBS)
-1 DAYS	Fluid intake variable depending on waking weight and athlete preference. Some may like to stop drinking fluid 24 hours before weigh-in. Others may like to continue sipping fluid all day and sweat a little more.
WEIGH-IN DAY (10:00AM)	NO FLUID UNTIL AFTER WEIGH-IN.

IV: MANIPULATING FLUID INTAKE

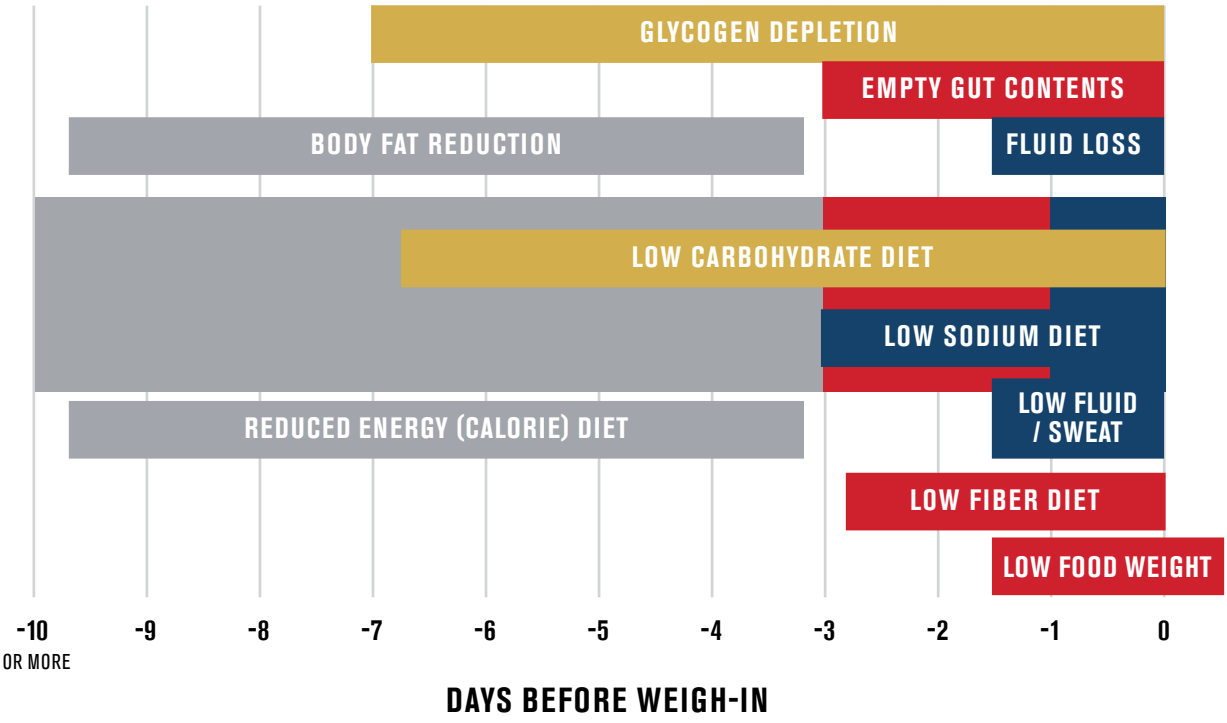
A 24-hour fluid intake restriction (< 300 ml or 10 oz) normally produces one to two percent body weight loss. Urine will continue to be produced for some time, and some water will be lost in sweat and other evaporation. However, once fluid intake is reduced, urine and sweat losses become more difficult. Therefore, it makes sense not to restrict fluid too early before weigh-in, and 24 hours (or slightly less) appears optimal. There are also other ways to increase urine and sweat production, namely through water loading. Water loading (i.e., drinking large volumes of fluid for several days prior to restriction) is widespread in MMA and other weight-category sports and has been scientifically proven to work—at least for some athletes. Risks with water loading and excessive water consumption while sweating during training can lead to a clinical condition known as hyponatremia. Hyponatremia is a condition in which blood sodium drops to dangerous levels. Hospitalization, and even death, can occur. Due to these risks, the UFC PI recommends the following research-backed, water-loading protocol (see Table 74.2).

V: EXPELLING FLUID FROM THE BODY

When it comes to expelling more fluid from the body, there are two different ways to do it: i) active sweating and ii) passive sweating. These methods can be combined. Active sweating is accomplished by raising the fighter's body temperature through exercise and forcing the body to sweat in order to cool body temperature down— sometimes known as "working it off." The benefit to this method is that many fighters have planned training sessions in the 24 hours before weigh-in, so by engaging in this planned training and not replacing any sweat losses with fluid, it causes a minimal disturbance to a fighter's routine. The disadvantages to this method are: i) while weight loss through sweating is easy when hydrated, if a fighter is already moderately to severely dehydrated, getting further weight loss by "working it off" becomes increasingly harder and requires a lot more work than it would have initially, and ii) while some training is often planned to take place the day before weigh-in regardless of making weight, extra training to sweat the weight off can result in muscle damage, soreness, fatigue and muscle tightness.

Passive sweating is a non-exercise based method used to increase body temperature and force sweating to occur. Examples include saunas, hot baths, heated rooms, extra layers of clothing and sweat suits—among others. The benefits to these methods include less muscle soreness, less fatigue and tightness and it may be less time consuming than active sweating. The disadvantages include discomfort to the athlete (especially compared to active sweating in the early stages of a planned weight cut) and some other unfavorable physiological responses (e.g., greater disturbances in electrolyte homeostasis and fluid losses from plasma, which in turn decreases cardiovascular fitness). Despite this, these unfavorable physiological responses can be recovered from with a strategic plan given the large window between the weigh-in and fight in professional MMA. As training sessions are likely planned to occur the day before weigh-in, and sweat losses occur relatively easily in the beginning of a weight cut when one is well hydrated (and especially when water loading), a combination of active and passive sweating, alongside a fluid restriction in the last 24 hours, seems ideal.

FIGURE 74.2
WEIGHT CUTTING STRATEGY



VI: SODIUM AND WATER RETENTION

When sodium is lost in sweat, consuming sodium-rich fluids or food helps to replace any losses and retain fluid. Because of this mechanism, reducing sodium intake prior to weigh-in will also assist with weight loss. We recommend reducing sodium as much as possible in the 48 to 72 hours prior to weigh-in.

VII: PUTTING IT ALL TOGETHER

As you can see, cutting weight is more than just sitting in a sauna until you have made weight or passed out. Using the strategies outlined here, a fighter can effectively and safely lose 10 percent of his or her body mass without putting health at risk. This is only achievable if the fighter is well hydrated and has consumed adequate carbohydrate and fiber prior to using these methods. Figure 74.2 above illustrates the combination of all the above strategies and when best to apply them during fight-week.


OFFI



PART 4
SECTION 75

SECTION 75: MINIMIZING THE EFFECTS OF TRAVEL

By Matthew Crawley, Taylor Wang and Duncan French

TRAVEL CAN AFFECT YOUR HEALTH WITH ALTERATIONS IN SLEEP, NUTRITION AND RECOVERY

1. TRAVEL SCHEDULE

a. Reduce training volume and intensity two to three days before
b. Consume melatonin pre-bed time to aid in sleep and circadian phase shift
c. Maintain a consistent sleep time and pre-bed ritual

2. TRAVEL STRATEGY

a. Jet lag can cause physiological disturbances when traveling across time zones
b. East-to-west and wet-to-east travel affects the body in different ways

3. SLEEP

a. BEFORE: Utilize melatonin recommended dosages to combat sleep disturbances
b. DURING: Maximize sleep during travel time
c. Use natural light to optimize circadian rhythms
   i. Limit exposure to blue light one hour before (TV, cell phones, tablets, artificial light)
   ii. Wear blue-light blocking glasses to protect from prolonged exposure linked to eye strain and sleep cycle disruption

4. UPON ARRIVAL

a. Perform 20 to 30 minutes of a low-intensity shakeout session to reduce joint and muscle stiffness
b. Aim to gain light exposure mid-morning (30-60 min) while avoiding exposure mid-afternoon
c. Once settled, take 20 to 30-minute nap if needed to recharge

NUTRITIONAL HABITS

BEFORE: Pack healthy food choices with snacks, fluids and meals if needed
   i. Maintain usual fueling habits while considering food availability
DURING: Drink plenty of water and electrolytes, unless restricting fluid, while avoiding caffeine and alcohol in the late afternoon
   i. Research meal services available (staple foods, key nutrients, cooking styles)
AFTER: Consume meals that are in alignment with individualized nutritional plan

WHAT IS JET LAG?

Jet lag is a condition in which alterations in key bodily functions occur with feelings of fatigue, confusion, sleep and gastrointestinal disturbances when traveling between different time zones. The body's circadian rhythm (24-hour body clock) has daily rhythms that are affected by environmental stimuli such as travel.



A DEEPER LOOK INTO CIRCADIAN RHYTHMS

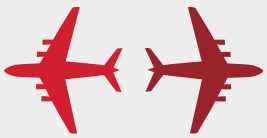
Circadian rhythm is the body's internal clock that can affect body temperature, melatonin and the light-dark cycle. Disruptions in circadian rhythm can cause delay in food absorption. Behavioral, nutritional and environmental precautions can reduce mental or physical effects of travel. Circadian phase shifting can improve alertness and rate of adjustments.

TIME ZONE TRAVEL TIPS

PRE-TRAVEL	- Commence circadian rhythm adjustment to new time zone prior to arrival - Optimize sleep by staying awake to adjust to desired time zone
INTRA-TRAVEL	- Drink plenty of fluids unless restricting, while avoiding alcohol and caffeine - Maximize sleep - Perform light stretching - Consume small meals in the evening - Wear comfortable clothing to aid rest and relaxation (or compression, based on preference and/or risk factors)
POST-TRAVEL	- 20- to 30-minute naps at circadian rhythm - Expose to light 30 to 60 minutes in the morning, avoid late mid-afternoon

DIFFERENCES

Traveling west causes a longer day. Traveling east causes a decrease in 25 to 26 hours of circadian rhythm.



EAST-TO-WEST

1. Half-day per time zone to adjust
2. Exposure to light should be in the morning and avoided in the evening
3. Perform exercise in the morning to delay circadian phase shift

WEST-TO-EAST

1. One day per time zone to adjust
2. Exposure to light should be in the mid-afternoon/evening and avoided in the morning
3. Perform exercise in early evening to adjust circadian rhythm





PART 4
SECTION 76

SECTION 76: AVOIDING ILLNESS AND INFECTION

By Robert Gaisford



HABITS

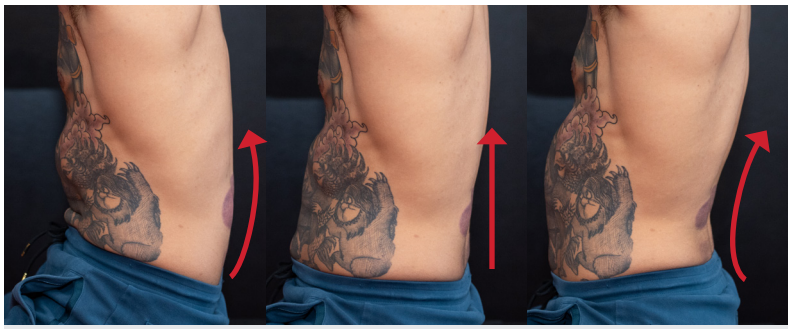
- Select the window seat
  - Lowest interaction with others and exposure to germs
- Wipe down all commonly touched areas (e.g., tray, arm rests, seat belt, air and light controls) with disinfectant wipes
- Use hand sanitizer frequently to avoid infection from touching common surfaces (e.g., tray table, armrest
- Use good nutrition practices to help boost immune system and avoid any gut issues during travel
- Turn on air flow
  - Creates a protective cone around you
  - Studies show airplane filtration removes 99.9 percent of infectious particles
- Use a saline nasal spray every two hours
  - Keeping membranes moist avoids infection
- Wear compression garments
  - Garments should provide 15 to 20 mmHg pressure for healthy people to avoid swelling issues while flying
- Stay hydrated

CONSIDERATIONS

- Get up and move every hour on longer flights (See next page got mid-travel exercises)
  - Increases blood flow, and counteracts poor sitting posture
- Use a neck pillow, roll a small towel or jacket and place in low back for lumbar support and be conscious of posture
- Don't avoid drinking water because of inconvenience (e.g., having to get past other seated travelers) or drink water from faucet
- Don't eat unwashed veggies, raw meats or drink from bottles that are unsealed while traveling in other countries
- Only eat fruits you can peel
- Avoid sitting near the bathrooms in order to mitigate interactions with others in high traffic areas

MID-TRAVEL EXERCISES

These exercises should be considered on longer trips (e.g., greater than 2-hours). The exercises are designed to increase blood flow and reduce the strain on the body from poor travel posture and sustained periods of sitting.



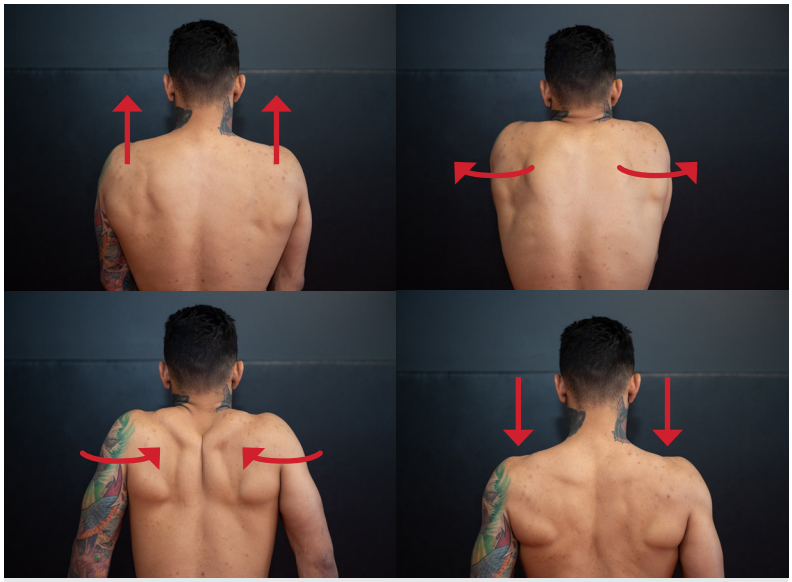
SEATED PELVIC TILTS

Cat/camel lumbopelvic movement, lower core activation



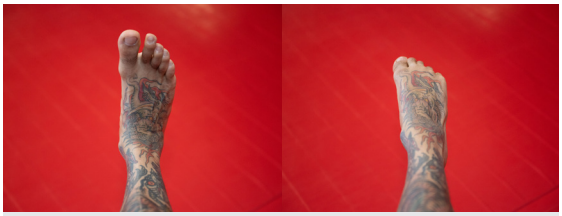
CERVICAL RETRACTIONS

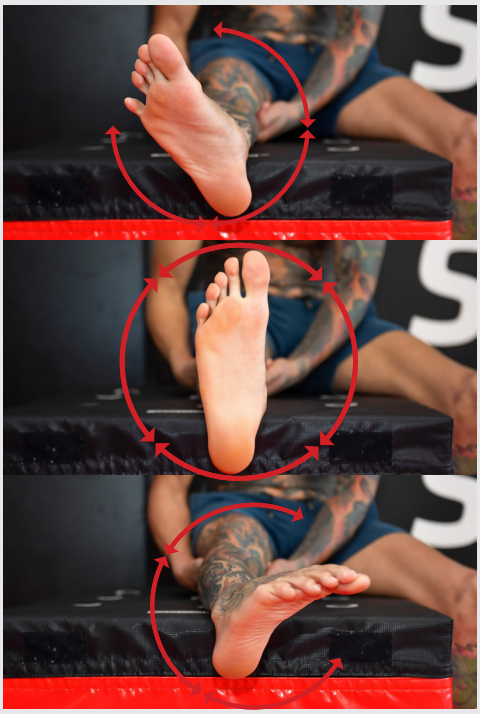
Tucking chin, trying to push ears into seat



SCAPULAR CIRCLES

Controlled articular rotations through elevation, protraction, depression and retraction





SEATED CALF PUMPS AND ANKLE CIRCLES

Increased blood flow in lower extremities

ON LONGER FLIGHTS, GET UP WALK, DO SOME EXERCISE

(e.g., calf raises, squats, arm pumps) and stretch hamstrings, hip flexors, quadriceps and back

TWO SETS OF 10 REPETITIONS OF EACH EXERCISE EVERY 45 TO 60 MINUTES

Especially if history of neck or back tightness



PART 4
SECTION 77

SECTION 77: TRAVEL NUTRITION

By Taylor Wang and Alexa Eisenberg

1

BEFORE YOU GO

Consider the number of days until the fight and plan accordingly

Eat a meal if you can

Pack snacks based on your needs:

Carbohydrate snacks: fruits, granola bars, pretzels/crackers

Protein snacks: nuts/nut butter, protein bars, jerky

Consider supplements

SUPPLEMENTS RELATED TO TRAVEL

MAGNESIUM	WATER RETENTION
ZINC	MENSTRUATION SYMPTOMS
VITAMIN C	IMMUNITY
PROBIOTIC	GUT HEALTH, KEEP YOU REGULAR
MELATONIN	SLEEP/JET LAG
MULTIVITAMINS	PREVENT DEFICIENCY

2

AT THE AIRPORT/STATION/IN YOUR CAR

Choose nutrient-dense, high-protein foods

Choose a variety of colors (eat a rainbow!)

3

DURING TRANSPORTATION

Try to resemble a balanced plate as best as you can with available meal service

Do not forget hydration (unless restricting fluid!)

4

WHEN YOU ARRIVE

Pay attention to food safety, especially when traveling internationally

Avoid trying things you are unfamiliar with

Build your plate as best as you can at the hotel or restaurants

KEY CONSIDERATIONS

Plan ahead!

Consider distance and destination of travel, number of days until the fight, and plan accordingly in terms of amount and types of foods to pack.

Food safety

Pack non-perishable snacks or bring a cooler

Always wash your hands before eating

Bring antibacterial wipes to sanitize surfaces

Check if the tap water is safe to drink

Be mindful of doping risks

Choose fish or chicken over red meats

Avoid processed meats

Water retention

Make a hydration plan

Pay attention to sodium intake

Consider the phase of camp

Off-camp or traveling for fight week

Jet lag





PART 4
SECTION 78

SECTION 78: ROLE OF MEDICAL SERVICES DURING FIGHT-WEEK

By Heather Linden

The UFC PI now supports the majority of UFC events with sports medicine services. The role of the sports medicine staff during fight-week is not to screen fighters who are carrying injuries and "pull" them from the fight card. Rather, it is to help fighters perform at their very best when fight night comes, despite any injury limitations. These sports medicine services can be pivotal for fighters, and there are a number of different areas that sports medicine staff can help fighters with during fight-week. These include:

ASSESSMENT OF PHYSICAL LIMITATIONS

These are either issues that have been affecting the quality of fighter training for a long period (chronic injuries) or are issues that have occurred recently (acute injuries). The sports medicine staff should then work with the fighter to help reduce the impact of the chronic or acute injury on upcoming fight performance. This can be achieved through manual treatments (e.g., joint mobilization and manipulations, soft-tissue massage), remedial and corrective exercises and acupuncture or dry needling techniques—to name a few.

SKIN INFECTIONS AND WOUND CARE

Untreated skin infections and wounds can be potential causes for fighters to be withdrawn from a fight, as they can pose a health risk to the other fighter. The sports medicine staff should address these and minimize the risk of fighter withdrawal through application of topical treatments to address skin infections or by cleaning, dressing and treating any wounds.

CRAMPING OR OTHER NEGATIVE EFFECTS FROM CUTTING WEIGHT

Sports medicine staff should be prepared to help alleviate some of the negative effects of weight cutting. One example is providing massage to any areas affected by cramping. This should be done in close consultation with the fighter's sports nutrition staff to help to support the weight-cutting process.



RECOVERY

Massage, stretching and other modalities (e.g., Normatec) are also provided by the sports medicine staff. All of these recovery techniques can help alleviate any stiffness or tightness from long-distance travel or from any training over fight-week.

MEDICAL EMERGENCIES

The sports medicine staff should also be available to support fighters through any first aid emergencies that may arise during fight-week. This may entail providing immediate care or recognizing significant "flags" and referring for further medical attention.



SPORTS MEDICINE DURING FIGHT WEEK

ACUTE INJURIES	CHRONIC INJURIES	SKIN INFECTIONS
REDUCE INFLAMMATION	DECREASE PAIN	REDUCE INFLAMMATION
DECREASE PAIN	IMPROVE FUNCTION	DECREASE PAIN
IMPROVE FUNCTION	IMPROVE STRENGTH	CLEAN AND DISINFECT SKIN
IMPROVE STRENGTH	INCREASE BLOOD FLOW TO AREA	TOPICAL CREAM TO REDUCE OUTBREAK
IMPROVE BALANCE	STIMULATE CELLULAR REGENERATION	ATHLETE EDUCATION
IMPROVE GAIT	REDUCE INFLAMMATION IF PRESENT	PROVIDE APPROPRIATE COVER/BANDAGES
PROVIDE OVER-THE-COUNTER MEDS IF NEEDED	PROVIDE OVER-THE-COUNTER MEDS IF NEEDED	CONNECT ATHLETE WITH MEDICAL DOCTOR IF NEEDED FOR RX
SPEAK WITH COMMISSION ON BRACING	SPEAK WITH COMMISSION ON BRACING	

CRAMPING	WOUND CARE	RECOVERY	MEDICAL EMERGENCIES
WORK WITH NUTRITION	CLEAN AND DISINFECT WOUND	NORMATEC	CHECK VITALS (HR, 02, BP)
PROVIDE SOFT-TISSUE MASSAGE	BANDAGE WOUND	GAME READY	PROVIDE CPR
	REMOVE STITCHES	STRETCHING	ASSESS WHEN EMTS ARE NECESSARY
PROVIDE GENTLE STRETCHING	REMOVE SPLINTERS	SOFT-TISSUE MASSAGE	
POSITION EDUCATION	PROVIDE STERI-STRIPS	COLLABORATE WITH NUTRITION-MELATONIN	
	PROVIDE SUPER GLUE		
	PROVIDE TAPING TO PROTECT WOUND FOR TRAINING		


UFC
25 YEARS
BODYARMOR
UFC
BODYARMOR
UFC
25 YEARS
BODYARMOR
UFC



PART 4
SECTION 79

SECTION 79: POST WEIGH-IN REHYDRATION AND FIGHT DAY NUTRITION

By Reid Reale and Charles Stull

Strategic refueling and rehydration is critical for fighters following making weight. The post-weigh-in period should be used to replenish specific nutrients that were depleted and are important for performance. This includes restoring glycogen (stored carbohydrate) along with fluid and electrolyte balance. In addition to this goal, athletes also need to manage any gastro-intestinal (gut) discomfort and prepare (mentally, physically and nutritionally) for their fight. Estimating post-weigh-in nutrition recovery requirements ahead of time as accurately as possible and preparing the appropriate fluids and foods is vital and will allow recovery to begin immediately post-weigh-in.

DETERMINING NUTRIENT TARGETS

Fluid

Identifying the amount of fluid loss required to make weight is important in developing targets for rehydration. To do this, we need to know the euhydrated (neither dehydrated or over- hydrated) body weight prior to initiating fluid loss. This can be challenging to pinpoint, particularly if dehydration strategies are utilized greater than 24 hours prior to weigh-in. Assuming fluid intake was high until at least Wednesday night for a Friday morning weigh-in, we can use the waking weight on Thursday morning to determine fluid needs. For example, if the athlete wakes up three kilograms heavier than his or her eventual weigh-in weight and had been eating low fiber in the previous two to three days, we can assume the three kilograms remaining to make weight will come almost exclusively from fluid loss. To compensate for ongoing urine losses, around 150 percent of any fluid deficit needs to be consumed to restore hydration levels. Drinking a little more will not hurt, providing adequate sodium is ingested and it doesn't cause gut discomfort. However, consuming more than twice the fluid lost on the day of weigh-in is not advisable, so 150 to 200 percent of the weight loss should be the target. On fight day, fluid intake should be in line with what an athlete usually consumes in order to feel ready for training/sparring.

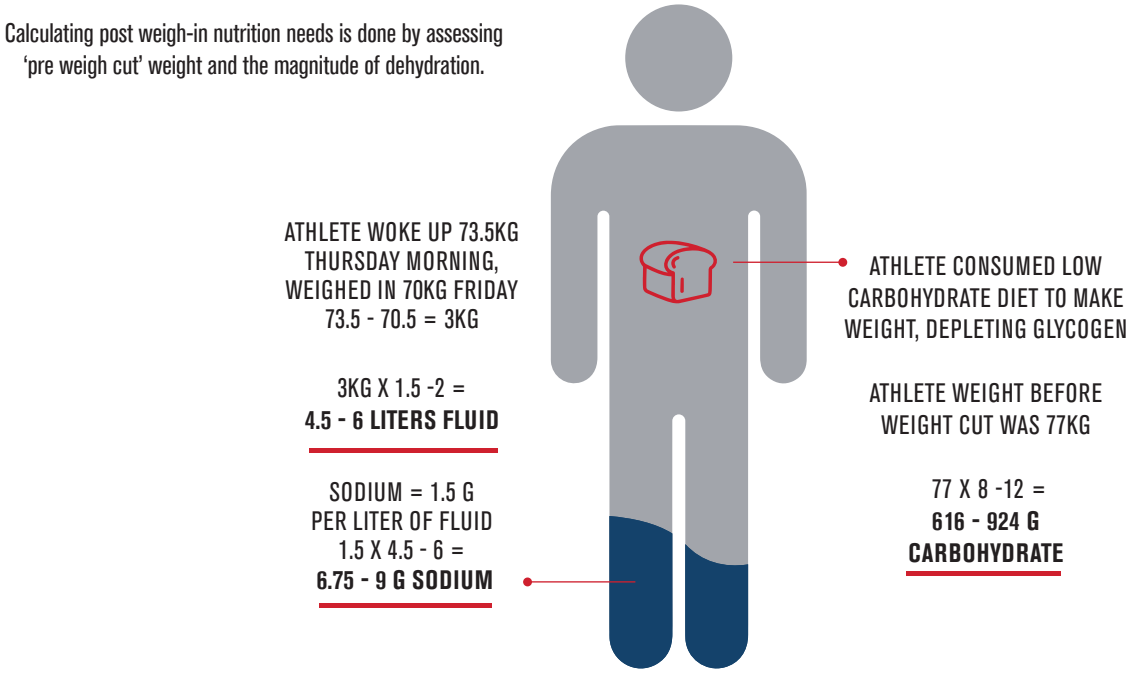
Sodium

Sweat losses are comprised of both fluid and electrolytes, primarily sodium and chloride, and these both need to be replaced when lost. As sweat sodium concentrations range from around 0.5 to 1.75 grams of sodium per liter, there is no perfect "one size fits all" approach to prescribing sodium concentration in a rehydration drink. In general, however, the more sodium in a drink, the better the body will retain it, and any excess sodium will be excreted in urine. Therefore, aiming toward the mid to higher end of the range makes the most sense for fighters (e.g., 1.5 grams of sodium per liter). An important consideration is that sodium in both fluid and foods consumed will assist with restoring hydration status and the weight lost during the weight cut. Sports drinks are usually quite low in sodium, whereas oral rehydration solutions— which are typically used in the treatment of acute diarrhea or vomiting—contain more optimal amounts. In the early stages of recovery after making weight, when food intake should be limited to not upset the gut, using an oral rehydration solution is ideal. When food is gradually reintroduced after making weight, consuming salty snacks alongside sports drinks and other fluids will increase the total sodium ingested and therefore assist rehydration. Finally, increased energy (calories) in any food or fluid will slow the emptying of fluid from the stomach. So in the early stages of recovery, fluids and electrolytes—primarily sodium—should be the priority, with substantial increases in energy and carbohydrates occurring later in the day.

Carbohydrate

We know carbohydrates are crucially important for high-intensity performance. Further, and especially in MMA, extra body weight (which will occur with glycogen replenishment and glycogen supercompensation (i.e., carbohydrate loading) is often desired. Therefore, post-weigh-in nutrition should include enough carbo-

FIGURE 79.1
ESTIMATING POST WEIGH-IN NUTRITION NEEDS



hydrates to at least fuel the athlete for the fight and also maximize glycogen stores if the required volume of food does not prevent rehydration or cause gut discomfort. A post-weigh-in carbohydrate intake of 8-12 g/kg is appropriate. Fighters prone to gut discomfort, or with less interest in increasing weight for the fight, may want to aim for the lower end of the range. Of course, if no glycogen depletion has been used in the weight cut, then no aggressive carbohydrate intake is required post-weigh-in and athletes can adopt a more moderate pre-fight carbohydrate intake.

MANAGING GUT DISCOMFORT POST WEIGH-IN

Ideally, post-weigh-in food and fluid intake should fully recover nutritional status while avoiding any gut discomfort. A low-fiber diet for a period of two to four days is likely the least detrimental weight-cutting technique. Further, the reduced gut content from a low-fiber diet will not limit performance, providing energy intake is sufficient and does not require post-weigh-in replacement. In fact, sudden reintroduction of dietary fiber after a weigh-in may slow nutrient absorption and cause gut discomfort. This is also true for large fat intakes. Further, fat and fiber may also displace absorption of other more important nutrients, in particular carbohydrates. Therefore, athletes should limit dietary fiber and fat post weigh-in. Even protein intake should remain low in the first six hours post weigh-in (potentially only one serving equating to 20 to 30 grams) and remain only moderate until after the fight. Recovery efforts should focus on meeting fluid, sodium and carbohydrate targets. Selecting high glycaemic index (GI) carbohydrates will help prevent gut discomfort, ensure foods are absorbed rapidly and assist with maintaining appetite.

Timing of Food and Fluids Post Weigh-In

With a weigh-in being during the morning on the day prior the fight, there is ample time to ingest the required nutrients for competition, providing this food and fluid intake is well planned and severe gut discomfort is avoided. It is advisable to be conservative with fluid and food intake immediately after weigh-in, assuming some degree of dehydration and reduced and/or altered food intake has taken place in the hours and days prior. We recommend initiating rehydration with approximately 500ml of an oral rehydration solution consumed during 10 to 15 minutes to assess fluid tolerance and the rate at which the athlete can begin to progress through the recovery phases. Following this, the continued drinking of high-electrolyte drinks for the first two hours post weigh-in is recommended with the introduction of easily eaten and digested carbohydrate-based snacks toward the end of this period. Three to six hours post weigh-in can see the introduction of more substantial—but still easily eaten and digested—carbohydrates, alongside continued fluid intake. From six hours after the weigh-in, resumption of main meals and snacks can begin with fighters still prioritizing high-carbohydrate, low to moderate protein, low fiber and low-fat options.

TABLE 79.1
POST WEIGH-IN RECOVERY PHASES

	KEY CONSIDERATIONS	TACTICS
1-2 HOURS POST WEIGH-IN	**ACUTE REHYDRATION PHASE**	
	Gastrointestinal fluid tolerance Electrolyte and carbohydrate osmolarity Re-introduce solid foods when tolerable	Utilize oral rehydration solution (1 to 1.5 liters per hour) Utilize fast-acting carbohydrates with low osmolarity at a tolerable rate of ≤60 grams per hour Re-introduce easily digestible starchy carbohydrates as tolerated (i.e., saltines, bagels, rice cracker, etc.)
3-6 HOURS POST WEIGH-IN	**NON-ACUTE REHYDRATION PHASE**	
	Continue prioritizing fluid intake Fluid intake MUST contain electrolytes to restore fluid balance Continued re-introduction of more complex carbohydrates	Fluid must contain electrolytes: primarily sodium, potentially also potassium and chloride Utilize simple and easily digestible starchy carbohydrates as tolerated (i.e., white rice, potatoes, sweet potatoes, pasta, etc.)
6+ HOURS POST WEIGH-IN	**MUSCLE GLYCOGEN RESTORATION PHASE**	
	Maximize muscle glycogen Minimize bloating and gastrointestinal distress	Prioritize carbohydrate intake, ingesting only low to moderate protein Avoid high-fat foods, as these will delay gastric emptying Eat small frequent meals, rather than a single large bolus

Post Weigh-In Recovery Phases

Recovering post weigh-in requires strategic implementation of rehydration and refeeding, especially as a fighter's gut may be extremely sensitive to the amount and type of nutrients ingested following a weight cut. Post-weigh-in recovery is broken into three distinct phases designed to optimize rehydration and muscle glycogen restoration. These phases are displayed in Table 79.1.

Pre-Fight Nutrition

While a fighter should take a scientific approach to the entire weight-making process, the time immediately before a fight requires a blend of science and art to provide vital nutrition while also supporting an individual athlete's preferences. Ideally, full post-weigh in recovery will be achieved prior to sleeping the night before the fight which will allow the fighter to focus on the event the next day. However, in situations when a later weigh-in occurs or when recovery targets are unable to be met the day before the fight, balancing these two priorities may difficult. Fighters should identify ahead of time which high-carbohydrate foods and sodium containing fluids they are comfortable eating prior to competition. This way, they can continue to recover from making weight while also preparing mentally for the fight. Aside from its role in the regaining weight lost during a weight cut, carbohydrate intake prior to exercise is a well-recognized strategy to improve athletic performance. Consuming at least 1 g/kg of carbohydrate two to four hours prior to a fight is recommended with a carbohydrate-based snack 30 to 60 minutes prior to the fight, if the athlete can tolerate it. Table 79.2 details a sample post-weigh-in recovery plan.

TABLE 79.2

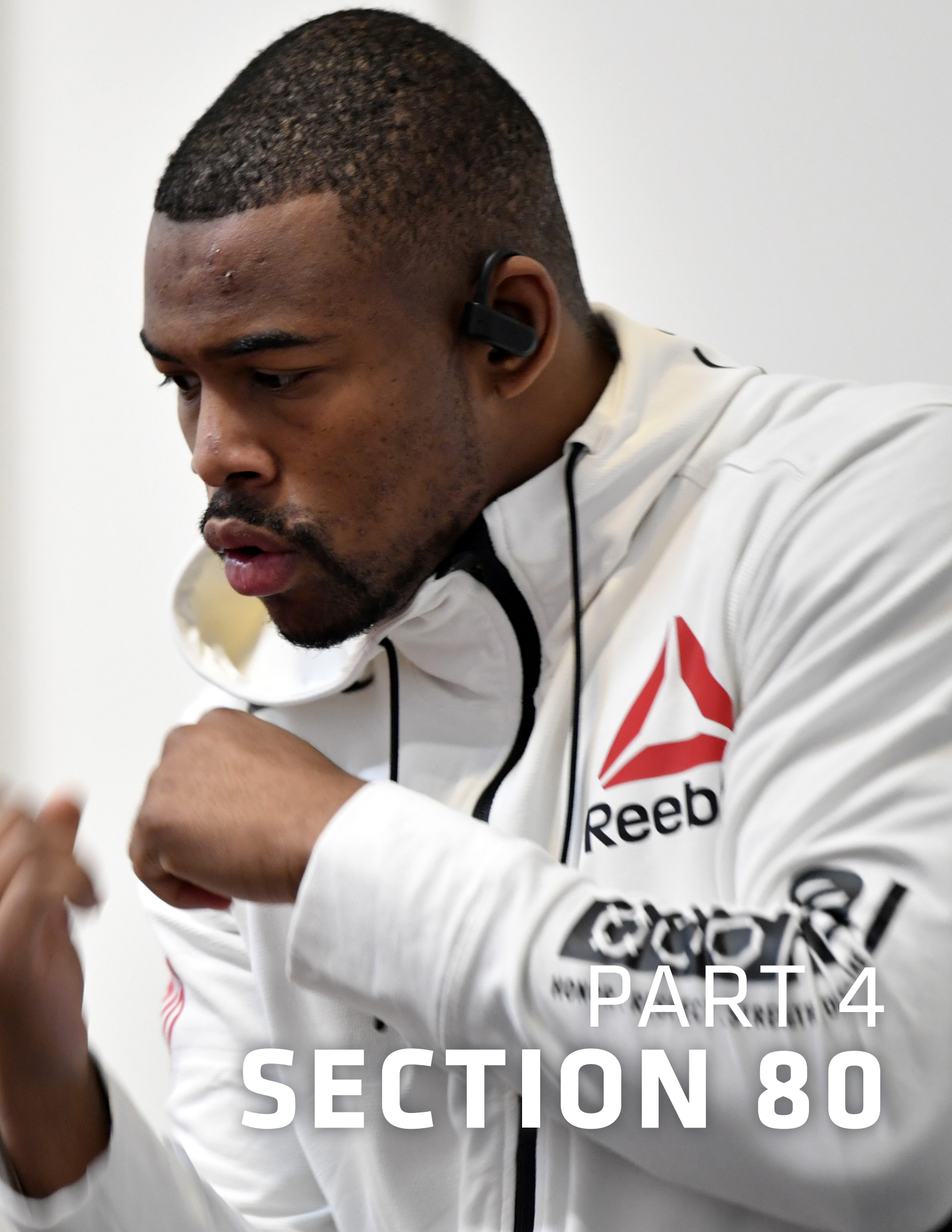
A SAMPLE POST WEIGH-IN RECOVERY PLAN FOR A MMA ATHLETE

Example post-weigh-in recovery plan for a UFC Welterweight: Fighter weighed 84kg at start of fight week and cut 4.5kg in fluid in the final 24 hours

TIME	FOOD	CARBOHYDRATE & SODIUM CONTENT
0 TO 60 MINUTES POST WEIGH-IN	Oral rehydration solution (1.5 to 2 liters)	1,500ml fluid ~3 to 4g carbohydrate ~2,760 to 3,680mg sodium
1 TO 2 HOURS POST WEIGH-IN	750ml oral rehydration solution 750ml sports drink 2 slices white bread and honey	1,500ml fluid ~110g carbohydrate ~1770mg sodium
2 TO 6 HOURS POST WEIGH-IN	1,500ml sports drink 1,000ml water 50g pretzels 50g sports candy 2 cups white rice and a small amount of lean meat with sweet soy sauce	2,500ml fluid ~300g carbohydrate ~2000mg sodium
6 TO 12 HOURS POST WEIGH-IN	1,000ml sports drink 1,000ml water Large bagel with jam 2 cups pasta with tomato sauce 2 cups white potato with small beef steak	2,000ml water ~370g carbohydrate ~2,300mg sodium
TOTAL INTAKE BEFORE BED		7,500ml water (~170 percent of fluid deficit) ~784 g carbohydrate (~9g / kg) ~8,830mg sodium (~1200mg/l)
SLEEP		
FIGHT-DAY BREAKFAST	1.5 cup oats, milk and a small amount of soft fruit 1 cup coffee, 1 cup water	600ml water ~60g carbohydrate ~30mg sodium
FIGHT-DAY MORNING SNACK	Granola bar 375ml sports drinks	375ml water ~50g carbohydrate ~180 mg sodium
FIGHT-DAY LUNCH	1.5 cups white rice and a small amount of meat	350ml water ~75g carbohydrate ~60g sodium
FIGHT-DAY AFTERNOON SNACK	Medium-sized banana	100ml water ~25g carbohydrate ~3mg sodium
PRE-FIGHT SNACK	Granola bar 375ml sports drinks	375ml water ~50g carbohydrate ~180 mg sodium
TOTAL INTAKE BETWEEN WEIGH-IN AND FIGHT		9,300ml water (~200 percent fluid deficit) ~1,045g carbohydrate (~12g/kg) ~9,280 sodium (~1000mg/L)***

Note: Total sodium includes what is specifically provided in the plan. Athlete should be encouraged to add salt to meals as desired.





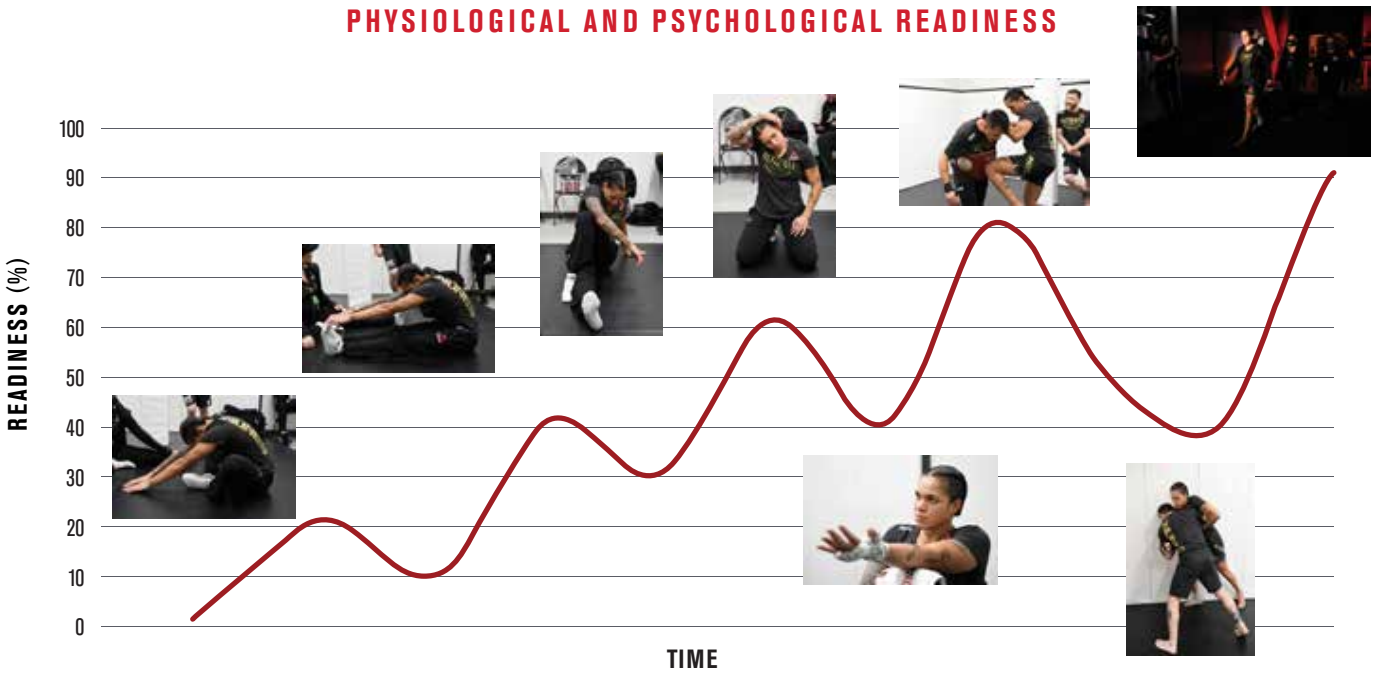
PART 4
SECTION 80

SECTION 80: FIGHT WARM-UP

By Gavin Pratt, Tom Wang and Richy Walsh

FIGURE 80.1
FIGHT DAY WARM-UP

	NON-TECHNICAL WARM-UP			TECHNICAL WARM-UP		
	MOBILIZATION	MOVEMENT	ACTIVATION	TECHNICAL	TACTICAL	PSYCHOLOGICAL
PRIMARY FOCUS	Soft-tissue preparation	Enchance acute range of movement potential	Neuromuscular potentiation	Technique overview	Game plan and tactics	Fighter's Forte (skill-based)
SECONDARY FOCUS	Psychological engagement	Increase body temperature and blood flow	Movement-specific preparation for TT warm-up	Increase physiological response	Reinforce figher/coach communication	Emotional management



The fight warm-up is an essential part of ensuring that competition performance is optimized. Ideally, the warm-up should act like a crescendo, building steadily across the day and then peaking at the moment of the fight, as can be seen in Figure 80.1. While UFC competitions may often have pre-determined timings within the fight-preparation period, amateur and local professional bouts may not offer the same luxury. Therefore, it is recommended that an athlete has an opportunity during fight-camp to become familiar with an individualized warm-up routine, and then alter the timing of each section below to suit respective situations. As the athlete moves through the non-technical phase of the warm-up (Acronym for the NTT warm-up is "MMA": Movement-Mobilization-Activation), he or she should become increasingly prepared to fight—both physically and mentally. This non-technical phase should also make a fighter start to feel fast and powerful, therefore accentuating the requirements of the subsequent technical phase of the warm-up. The technical phase should narrow the fighter's focus and build the appropriate level of arousal. In combination with breathing methods and mental-skill techniques (See Section 81), the coach and athlete should have the necessary tools to manage the fighter's arousal levels and confidence, which can be achieved by reinforcing strengths and redirecting doubts.

NON-TECHNICAL WARM-UP PHASE

I) SOFT TISSUE PREPARATION

- Loosen fascial adhesions or "knots".
- Increase range of motion via massage, foam rolling, mobility drills and flexibility (>2 to 3 hours before fight).
- Increase blood flow with methods such as PNF stretching, soft tissue tools, gentle movement or low-level blood flow restriction.

I) ENHANCE MOVEMENT POTENTIAL

- Specific drills to enhance range of motion required for MMA techniques (e.g., head kicks).
- Examples include:
- Loaded "flow" drills with kettlebell
- Dynamic stretches
- Animal/crawling movements
- Band-assisted mobility

I) NEUROMUSCULAR POTENTIATION

- Increased motor unit recruitment.
- Increased neural activation.
- "Turn on the electricity."
- Examples include:
- Visual cognition drills (e.g., use of tennis balls, stroboscopic tools)
- Low-level plyometrics: low-contact times, reflexive in nature (e.g., skipping, change-of-direction drills, agility drills, pogo jumps)

II) PSYCHOLOGICAL ENGAGEMENT

- Slowly increase arousal (e.g., morning movement flow upon waking).
- "Wide-to-narrow" focus as the day/evening progresses (e.g., begin fight-specific focus closer to the fight time, rather than build adrenaline too early in the day).

Examples include:
- Box breathing
- Combining breathing with soft-tissue work
- Video priming of fighter's positive performances
- Binarual beats and guided visualization strategies

II) INCREASE BODY TEMPERATURE AND BLOOD FLOW

- Ensure slightly elevated heart rate and blood flow to allow for greater movement potential. This phase also signifies to the autonomic nervous system that competition is nearing.
- Examples include:
- Increased speed of general movements (e.g., high-knee run, lateral shuffles, crossover step)
- BFR with increased intensity for upper and/or lower limbs

II) MOVEMENT SPECIFIC WARM-UP

- Increase movement specificity.
- Increase intensity.
- Examples include:
- Combining resisted technical drills (e.g.,band-resisted takedowns, band-resisted shadowboxing)
- Footwork drills and shadowboxing with various non-technical focus points (e.g., controllingvbreathing rate)

TECHNICAL WARM-UP PHASE

I) TECHNIQUE OVERVIEW

- General MMA techniques (non-specific to game plan).
- Increase awareness and sensitivity (e.g., reactionary drills for striking/wrestling/grappling).
- Increase fluidity (e.g., flow combinations and set drills with partner).

Examples include:
- Pad work
- Dutch drills
- Grappling
- Fence techniques

I) GAME PLAN AND TACTICS

- Revision of tactics and game plan. This not only allows for the athlete to recall the components of what it will take to win, it also allows a slight settling of energetic demands before a crescendois reached in the next phase of warm-up.
- Higher specificity toward fighter's perceived competitive advantages.
- Rehearsal of scenario-based movements and reactions.

I) FIGHTER'S FORTE

- Coach and fighter work to build confidence during the warm-up (e.g., instill confidence by focusing on strongest skillsets and athlete strengths, helping redirect doubts).
- Examples include:
- "Go time" cues built throughout fight-camp (e.g., hands being wrapped signify "the switch," personal music, video highlights)

II) INCREASE PRECISION, SPEED AND POWER

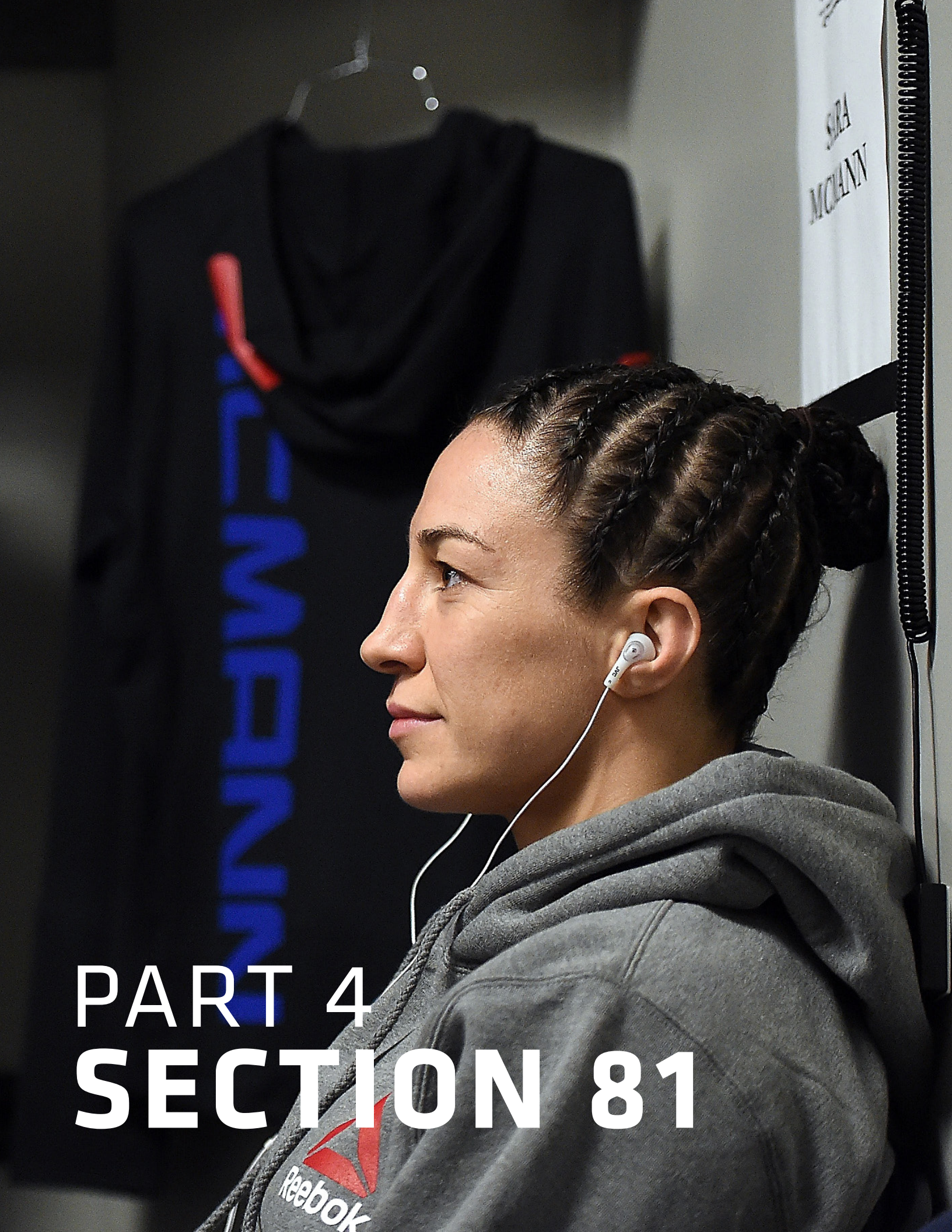
- Increase precision, speed and power (e.g., building the desired amount on pads as the warm-up progresses, coach-led).
- Following NTT W/U with sharp, crisp technique (e.g., reactionary drills, short-duration rounds "staying fresh").
- Maintain body temperature, ROM and neural activation without fatiguing the fighter.

II) REINFORCE FIGHTER/ COACH COMMUNICATION

- Fighter-coach language" (i.e., unique coach and fighter covert naming of techniques).
- Opportunity to consolidate final coaching cues (used throughout fight-camp and now during the fight and cornering duties.
- Examples include:
- Coach call outs: "zeroing in"
- Pre-determined corner and backstage communications
- Key combinations or words that elicit a desired action (e.g., Give me '1-2-X'… Causes the fighter to perform a 1-2- agreed upon technique).

II) EMOTIONAL MANAGEMENT

- Managing levels of adrenaline, fear and/or anxiety.
- Remain collected and cognitively lucid (dependent on the individual this may mean ramping up or bringing down autonomic nervous system prior to fight).
- Examples include:
- Mental Skills (See Sections 59 and 81)
- Note: Dependent on the fighter i) fighter forte and ii) emotional management can be both primary and secondary in focus.



PART 4
SECTION 81

SECTION 81: COMPETITION MINDSET

By Micah Schurnstein and Forrest Griffin

"FIGHT WEEK IS WHAT WE ALL TRULY WANT. IT'S WHERE SELFISHNESS IS ENCOURAGED, WHERE TO YOUR FRIENDS, FAMILY AND COACHES THE WORLD REVOLVES AROUND YOU. IT IS A WEEK WHERE EVERYBODY WANTS A PIECE OF YOU, AS THEY SHOULD BECAUSE YOU ARE THE STAR OF THE SHOW. IT'S A WEEK WHERE YOU DO JUST ENOUGH TO STAY SHARP. AND THE BEST PART OF IT IS THAT AT THE END OF IT YOU GET TO FIGHT!"

– FORREST GRIFFIN, UFC HALL OF FAMER

Fight week brings new obligations and increased distractions (e.g., media commitments, unfamiliar surroundings) that can take focus away from identified fight values. Staying focused on fight values during fight week allows fighters to better spend time being present on what matters to them and their competition performance. As the fight approaches, the work put together in off-camp and fight-camp comes to a head, which can bring new or challenging thoughts and emotions. Having established transferable routines can help fighters keep arousal levels from negatively impacting performance. Below are suggestions that a fighter can use during fight week—and the fight itself—to increase focus on identified values and better stay at an optimal level of arousal. The concept is that you can overlay your physical and mental routines throughout fight week which will provide some sense of normality in a potentially chaotic situation.

FIGHT WEEK

Create a schedule that continues to incorporate identified fight-camp values (e.g., nutrition, training, recovery) based around fight week obligations.

Eliminate distractions as much as possible (e.g., finances, travel plans, social media, team communication).

Set defined boundaries with family and friends (e.g., tickets, communication, visits).

Use mental skills (e.g., mindfulness, thought identification) to return focus to identified fight values if distracted by the many obligations during fight week.

Assign a point person that all outside parties (e.g., UFC, friends, family, manger) will communicate with so that there is a level of insulation between the fighter and the outside world"

BEFORE AND DURING THE FIGHT

Keep warm-up routines the same or very similar to what it has been for sparring in fight-camp. Fall back on what the fighter is familiar with and knows works for him or her.

Diaphragmatic breathing can be used to control arousal levels and keep the fighter focused as he or she completes the warm-up routine and in the fight.

Mental skills can also be used to control arousal, stay focused and increase a fighter's awareness of the present moment (e.g., strategy/tactics review and visualization).

Possible activities to include in a pre-fight routine that can be used to increase focus and optimize arousal are:

1. Music
2. Diaphragmatic breathing
3. Stretching
4. Strategy/tactics review
5. Visualization
6. Mindfulness/proprioception

When traveling to a fight, always keep all your fight gear (e.g., mouth piece, cup) in your carry-on bag, Another rule in the same vain is to pack your bags for the trip home before you leave for the fight, just in case there are any medical interventions or you party too hard.

PART 5

POST-FIGHT & TRANSITION

SECTION 82: POST-FIGHT CARE: INJURY EVALUATION

By Paul Holmes and Alice Ai

The priority of UFC medical staff on the day of an event is to ensure the safety of all competitors during and after competition. After each fight, as an athlete leaves the Octagon, they are screened for any significant trauma (e.g., signs of concussion, fractures or musculoskeletal injuries). If this screen is positive and highlights any injury, fighters are given immediate medical attention and referred for further investigation (e.g., diagnostic imaging), if needed. This process is outlined in Figure 82.1. The most common post-fight diagnostic imaging options and considerations around their use are also outlined in Figure 82.2.

FIGURE 82.1
POST-FIGHT MEDICAL CARE PROCESS AT UFC EVENTS

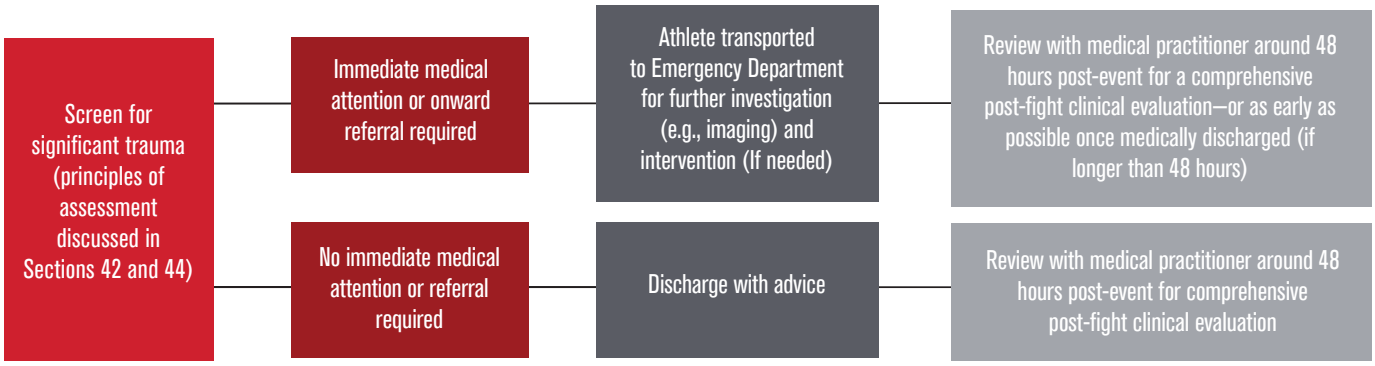


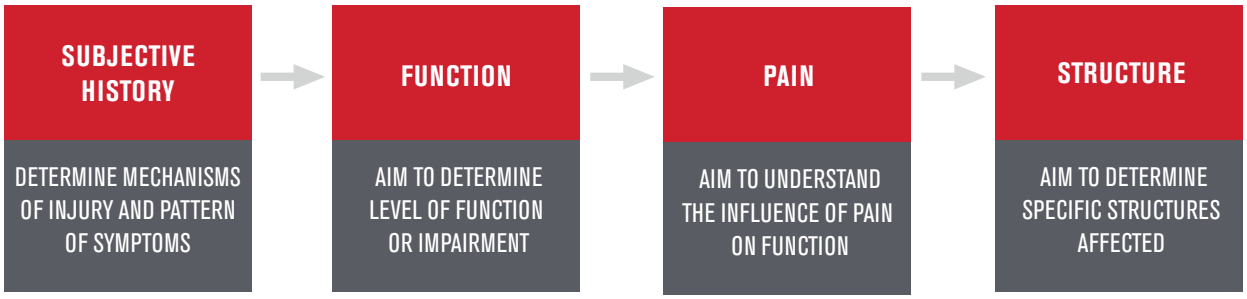
FIGURE 82.2
COMMON POST-FIGHT DIAGNOSTIC IMAGING OPTIONS AND CONSIDERATIONS

DIAGNOSTIC IMAGING		
X-RAY	**MAGNETIC RESONANCE IMAGING (MRI)**	**COMPUTED (AXIAL) TOMOGRAPHY (CT/CAT) SCAN**
RULE OUT POSSIBLE BONE FRACTURES. IN SOME INSTANCES, FRACTURES MAY NOT BE IMMEDIATELY VISIBLE ON X-RAY (E.G., SCAPHOID FRACTURES IN THE WRIST) AND MAY NEED FOLLOW UP AT A LATER DATE TO CONFIRM DIAGNOSIS.	COMMONLY PERFORMED TO IDENTIFY MUSCLE, LIGAMENT AND CARTILAGE INJURIES. PRESENCE OF SWELLING FROM ACUTE TRAUMA CAN REDUCE THE SENSITIVITY AND ACCURACY OF THIS TYPE OF IMAGING. IT IS TYPICALLY RECOMMENDED SEVERAL DAYS AFTER THE EVENT ONCE THE SWELLING HAS REDUCED.	PERFORMED TO EXAMINE COMPLEX FRACTURES (SUCH AS FACIAL INJURIES) OR TO IDENTIFY THE PRESENCE OF BLEEDING IN THE BRAIN. **NOTE: THE ABSENCE OF BLEEDING ON THE BRAIN IN A CT/CAT SCAN DOES NOT RULE OUT THE PRESENCE OF CONCUSSION, AS IT IS NOT A DIAGNOSTIC TEST FOR CONCUSSIVE INJURY.**



Comprehensive post-fight physical assessments with a medical provider should be sought approximately 48 hours after the event. In most cases, this allows adequate recovery from the acute trauma sustained in a fight, enabling fighters and medical providers to be able to differentiate between symptoms first experienced after a fight and to obtain a more accurate diagnosis. Key components of the post-fight clinical evaluation for medical providers are provided in Figure 82.3. Besides making sure to follow a medical practitioner's recommendations, there are a number of self-management strategies that fighters should also use after competition. The top five important self-management strategies are outlined in Figure 82.4.

FIGURE 82.3
KEY COMPONENTS OF A CLINICAL ASSESSMENT 48 HOURS AFTER A FIGHT



Along with the information gained from the subjective history, function, pain and structural clinical tests help to differentiate between soft-tissue soreness from the fight and actual injury, along with determining the severity of injury and structures affected.

Referral for further diagnostics should occur in cases where a clinical assessment does not offer a clear diagnosis or presents with high symptom severity (e.g., persistent or unremitting pain, excessive swelling, significant and non-improving loss of function since the fight, or an inability to weight-bear).

IMPORTANT

On occasion, diagnostic imaging can reveal "abnormalities" which are incidental findings that are unrelated to a fighter's symptoms. It is therefore crucial to match the imaging findings to the clinical assessment to establish a formal diagnosis.

FIGURE 82.4
THE TOP 5 SELF-MANAGEMENT STRATEGIES AFTER A FIGHT

1	2	3	4	5
POLICE IT	**FUNCTION AS BEST AS YOU CAN**	**REST**	**RECOVER**	**SEEK ADVICE**
FOLLOW THE POLICE PRINCIPLE TO MANAGE ACUTE PAIN (SEE SECTION 83)	FOLLOW YOUR MEDICAL PRACTITIONER'S ADVICE. MOVE AS EARLY AS YOU CAN WITHIN TOLERANCE TO RESTORE YOUR FUNCTION.	ALLOW YOURSELF TO TAKE PROPER PHYSICAL AND MENTAL REST TO PROMOTE HEALING.	RECOVER FROM ANY INJURIES BEFORE RETURNING TO TRAINING.	IF YOU ARE UNSURE, OR IF LIMITATIONS FROM THE INJURY REMAIN ONCE YOU RETURN TO TRAINING, SEEK EXPERT ADVICE FROM YOUR MEDICAL PROVIDER.





PART 5
SECTION 83

SECTION 83: POST-FIGHT CARE: PAIN MANAGEMENT

By Paul Holmes and Alice Ai

In the event of an injury, there are a number of guidelines to help manage the pain and injury in the early stages. It is common to not perceive pain as much during a fight due to the hormones that influence the fight-or-flight response. It is often only after the fight that a fighter becomes more aware of the pain from any injuries he or she may have sustained.

Pain is the body's protective mechanism to avoid further injury. However, the intensity of pain is not necessarily directly related to level of tissue damage. When evaluating pain, it is important to consider this intensity (normally as a rating out of 10) along with the quality of the pain and its relationship to function of the affected area. Understanding these characteristics is helpful in identifying the severity of injury.

VERBAL DESCRIPTORS AND NUMERICAL RATING OF PAIN



NO PAIN — WORST PAIN POSSIBLE

ACHING	SHARP	SHOOTING	NAGGING
BURNING	PULLING	HOT	HEAVY
THROBBING	STABBING	DULL	PINCHING
DEEP	SUPERFICIAL	CRAMPING	STINGING

	DOSE	FREQUENCY	INTERVAL
ADULTS	1000MG	4 TIMES DAILY	AT LEAST 4 HOURS
RECOMMENDATIONS		NO MORE THAN 4 DOSES IN 24 HOURS	

IF INFLAMMATION AND SWELLING PERSIST AFTER 48 TO 72 HOURS, FOLLOW THESE GUIDELINES:

	DOSE	FREQUENCY	INTERVAL
ADULTS	400MG	3 TIMES DAILY	AT LEAST 4 HOURS
RECOMMENDATIONS		TAKE WITH FOOD MOST EFFECTIVE WHEN TAKEN AS A COURSE AVOID PROLONGED USE (>7 DAYS)	

PARACETAMOL/ACETAMINOPHEN is recommended as a readily available over-the-counter medication to help with pain control.

Paracetamol/Acetaminophen works by blocking chemical messages in the brain that tell us we have pain. It takes effect approximately 30 minutes after a dose is taken and can last for up to six hours. Taken in the correct doses, Paracetamol/Acetaminophen is typically a very safe drug.

IBUPROFEN is classified as a non-steroidal anti-inflammatory drug (NSAID). Its main function is to reduce inflammation, which in turn, helps relieve pain. Its mechanism is to block the production of inflammatory chemicals that are part of the body's natural healing response.



IT IS NOT ADVISED TO TAKE IBUPROFEN IN THE FIRST 48 TO 72 HOURS, AS ITS MECHANISM OF ACTION CAN INHIBIT THE HEALING PROCESS

Consult with your doctor or a pharmacist before taking any medications if you have never used them before, if you have any medical conditions or are taking any other medications. If your pain remains uncontrolled following the above recommendations, consult with your doctor. In the event of a medical emergency, contact emergency services.

P	**PROTECT** | Protecting a new injury is important to prevent it from getting worse, particularly early on while determining what the actual injury is or how severe it may be. A methodical approach to assessing simple characteristics of function can help determine how severe it may be (see Section 42).
O L	**OPTIMAL LOADING** | This involves a fine balance between unloading the injured area, allowing structures to heal and recover, while at the same time loading the tissues adequately to maintain and help restore normal function. An example of this is using a pair of crutches to help with walking following a significant knee injury. Other ways of optimal loading include the use of Aircast boots, braces or slings.
I	**ICE** | Ice therapy has been traditionally advocated in acute injury management and has evidence to support its effect in pain relief. Application of ice is recommended for 10-minute intervals every two hours. Longer application periods can potentially be counterproductive to the healing process or even harmful.
C	**COMPRESSION** | Applying an elastic compression dressing (e.g., ace bandage or tubigrip) around an injured body part has been shown to help reduce swelling. By limiting the amount of swelling, there is less impact on function and therefore, this can be restored faster.
E	**ELEVATION** | Elevating the injured body part above heart height when resting helps drain the swelling around an injury. Like compression, this can help restore function faster.



AVOID ALCOHOL

Alcohol acts like an anti-coagulant (blood thinner) and increases how easily the body bleeds. This can have a significant impact on the swelling produced around an injury and impact speed of recovery.



DO NOT SMOKE

Smoking is also not advised after injury. It slows down the metabolic processes involved in the healing, in turn increasing the length of recovery time.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PART 5

SECTION 84

SECTION 84: NUTRITION CONSIDERATIONS FOR INJURY

By Reid Reale and Charles Stull

Injuries are commonplace in training and competition in MMA. For more information on common injuries, see Section 2. Aside from its role in promoting general health and preventing illness, nutrition plays an essential role in injury recovery and rehabilitation. To give an athlete the best chance of reducing surgical complications, minimizing muscle loss during immobilization, and optimizing their return to sport, the following priorities should be addressed:



PRIORITY 1

Energy
Caloric requirements should be identified and addressed. While an athlete may not be training as hard or with the same volume, resting energy needs will be increased by 1.2 (soft-tissue injury) to 1.5 (severe infection) times to promote repair and recovery.



PRIORITY 2

Protein
Higher protein intakes (2 to 2.5g/kg per day), as well as evenly distributing protein consumption throughout the day, will best maintain muscle mass and strength during times of immobilization, rest and recovery.



PRIORITY 3

Micronutrients
Consuming a wide variety of nutrient-dense, colorful plant-based foods as well "healthy fats" will ensure the intake of the wide variety of vitamins and minerals needed to facilitate wound healing and tissue repair.



PRIORITY 4

Sports Foods
Sports-food supplements (e.g., protein powder) may be helpful in addressing protein and energy needs (and distribution of protein intake) when appetite is poor.

Multi-vitamin/mineral supplements may also be helpful in supporting a fighter's needs if dietary intake of nutrient-dense foods is suboptimal.

BONUS!

PRIORITY 5

Supplements
Once the above points are addressed, recovery, therapy and rehabilitation can be enhanced—and potentially accelerated—via the use of specific supplements, helping fighters to recover faster and safely return to sport sooner.

SUPPLEMENT AND INDICATION	BENEFIT(S)	SUGGESTED PROTOCOL
 **CREATINE MONOHYDRATE**	Reduce muscle loss/increase muscle mass during immobilization following injury Replace decreased creatine stores in the brain which occur following brain injury/concussion	4 x 5g per day for five days (loading phase) followed by 5g daily for soft tissue/ immobilization injury 4 x 5g per day for brain injury/ concussion
 **OMEGA 3 (E.G., FISH OIL)**	Reduce inflammation in soft tissue and brain cells May also help reduce muscle loss during immobilization following injury	2g+ per day 40mg/kg per day for brain injury/concussion
 **CURCUMIN**	Reduce excessive inflammation in tissues—particularly muscle—decreasing muscle soreness. Particularly relevant in the weeks prior to a fight. Improve outcomes following concussion/ brain injury	1000mg per day for muscle soreness/general inflammation High doses required for brain injury. See Section XX
 **PROBIOTICS**	Taken alongside antibiotics, probiotics may decrease the incidence of bacterial infection post-surgery and reduce the negative impact of anti-biotics on gut health Repopulate gut bacteria after diarrhea, fasting or other gut disturbances	Taken daily during antibiotic therapy and 1 to 2 weeks following
 **VITAMIN D**	Positive effects on immune, muscle, bone and inflammatory functions Particularly important if suboptimal blood levels have been identified	5000IU's daily during rehabilitation phase until return to sport Higher doses if deficiency is identified
 **GELATIN + VITAMIN C**	Increased collagen synthesis, improving rehabilitation outcomes for ligament/tendon injuries	15g gelatin + 50mg Vitamin C (or gelatin dissolved in fruit juice) taken 60 minutes prior to rehab exercise
 **HMB, LEUCINE**	HMB and Leucine are important in stimulating protein synthesis Sufficient levels are easily achieved when protein intake is adequate (e.g., protein consumption of 2 to 2.5g per day when recovering from injury/surgery) However, following surgery or when medically unwell, may be used to support lower protein intakes to maximize protein synthesis when appetite/intake is poor.	HMB: 1.5g x 2 per day Leucine: 0.3g/kg with protein meals 3 to 5 times daily





PART 5
SECTION 85

SECTION 85: NUTRITION INTERVENTIONS FOR CONCUSSION

By Charles Stull

A host of nutritional targets for managing the array of complex biochemical and physiological processes dysregulated by acute traumatic brain injury are presented in Table 85.1. Return to play (RTP) following traumatic brain injury or concussion requires an integrated treatment plan, and as such these nutritional recommendations are designed to align with the RTP progressions highlighted in Section 45.

TABLE 85.1

NUTRITION INTERVENTION	DESCRIPTION	EARLY STAGES OF RECOVERY	LATTER STAGES OF RECOVERY
CREATINE MONOHYDRATE	Creatine monohydrate appears to be a promising aid in recovery from concussion. However, it has difficulty passing the blood-brain barrier and higher intakes may be needed to increase brain creatine levels.  TBI: lowers brain creatine stores, thus creatine supplementation can aid in restoring brain creatine.	0.4g/kg per day split in doses of 5g throughout the day (e.g., 80kg athlete 0.4g/kg per day = 32g creatine per day = ~6 5g doses per day)	Taper to 0.2g/kg per day then 5 to 10g total per day as recovery improves
DIETARY AND SUPPLEMENTAL FLAVONOIDS	Dietary and supplemental flavonoids have neuroprotective actions against reactive oxygen species released during cellular damage caused by concussion. Preliminary research has shown a higher dosage of flavonoids are necessary to illicit anti-inflammatory effect on brain inflammatory markers.	A diet rich in fruits, vegetables, tea and spices (e.g., turmeric, cinnamon, green tea) Curcumin supplement: 500mg T.I.D, (e.g. Thorne Meriva-SF)	
OMEGA-3 STATUS	A high dietary intake of Omega-3's coming from food sources and supplementation (2g per day) has anti-inflammatory and neuroprotective actions against the reactive oxygen species released during cellular damage caused by concussion.	Consume healthy fat sources rich in Omega-3 fatty (e.g., salmon, mackerel, flaxseeds, chia seeds, walnuts) Omega-3 supplement: 3,000mg ~2:1 DHA:EPA T.I.D (e.g., Brain Armor)	Consume healthy fat sources rich in omega-3 fatty acids (e.g. salmon, mackerel, flaxseeds, chia seeds, walnuts) Omega-3 supplement: *If dietary intake of Omega-3 is insufficient
ENERGY AVAILABILITY AND MACRONUTRIENT DISTRIBUTION	Energy needs can increase by up to 140 percent of resting metabolic rate post-concussion. A diet higher in fats will help meet energy needs and may help with brain recovery. Gradually increase carbohydrate intake as recovery progresses. Consume complex carbohydrates are preferred over simple carbohydrates.	Primarily fat fueled ~50 percent of total calories Protein 2g/kg per day Remaining calories should predominately come from fruit and non-starchy carbohydrates	Still primarily fat fueled but reduce to ~40 percent of total calories Protein 2g/kg per day Remaining calories should predominately come from fruit and non-starchy carbohydrates with exception of pre-anaerobic energy system training Progress to Energy Neutral Metabolic Efficiency or Balanced Plate fueling

NUTRITION INTERVENTION	DESCRIPTION	EARLY STAGES OF RECOVERY	LATTER STAGES OF RECOVERY
COMMON PROBLEMS POST-CONCUSSION			
GUT ISSUES	Concussion can dysregulate gastrointestinal motility and can cause issues like bloating and inconsistent bowel movements.	Include probiotic-rich foods in meals when able (e.g., kefir, kimchi, yogurt, sauerkraut, kombucha) Include prebiotic foods in meals (e.g., legumes, berries, asparagus and leafy greens), Probiotic supplement + 5g glutamine T.I.D.	Include probiotic-rich foods in meals when able (e.g., kefir, kimchi, yogurt, sauerkraut, kombucha) Include prebiotic foods in meals (e.g., legumes, berries, asparagus and leafy greens) Probiotic supplement + 5g glutamine post-workout
INSOMNIA AND/OR CIRCADIAN RHYTHM DISRUPTIONS	Nutrition/supplementation should aim to improve sleep latency and activate the parasympathetic nervous system to support sleep.	Focus on a diet rich in nutrients essential for the endogenous synthesis of melatonin (Ssection 17: Sleep Hygiene) 3-12mg melatonin and 100mg GABA before bed If dietary intake of Vitamin B, tryptophan and magnesium is insufficient, supplementation may be necessary.	If possible, transition to lifestyle-based (e.g., sleep hygiene) sleep interventions to combat sleep latency issues (see Section 72).




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PART 5
SECTION 86

SECTION 86: POST-FIGHT REVIEW

By Forrest Griffin, Richy Walsh, Dean Amasinger, Bo Sandoval, Kyle Larimer, Paul Holmes, Alice Ai and Clint Wattenberg

After each fight, a post-fight review should be undertaken with the fighter and support staff (e.g., MMA coaches, dietitians, strength and conditioning coaches, sports psychologists, physical therapists) with the goal to collectively appraise all elements of the last off-camp, fight-camp, and, of course, the fight itself. The post-fight review can vary dramatically based on whether a fighter wins or loses, the quality of performance and the duration of the fight. However, in asking the questions illustrated in Figure 86.1 against technical, tactical, physical and psychological elements of the fighter's performance, the fighter and support staff are able to better understand the factors that contributed to the fight outcome. This will also allow the fighter and support staff to optimize their collective practice in preparation for the fighter's next competition. Any post-fight review should be done with as much objectivity as possible, as well as a degree of separation from the emotions associated with the outcome of the fight. It is also worth noting that successfully reviewing a fighter's performance and preparation requires open communication and transparency between the fighter and all members of the support staff.

In regard to timing, a post-fight review can be done immediately after a fight or after the fighter returns to training, although this may depend on injuries or other commitments after a fight. The post-fight review may also occur in a number of stages, with a technical review of the fight first and reviews of the complete preparation across all support staff at a later date. The benefit of an immediate review (e.g., after two to five days) is that the fighter will more clearly remember his or her thoughts and feelings during the fight. Also, by completing a post-fight review in this timeframe, it may allow the fighter and support staff to move on from the result of the fight, decompress and enjoy their time off knowing they have the information to build a plan for improvement when off-camp resumes. This is especially important in the case of a tough loss or poor performance. Although a more delayed review may allow for the fighter and staff to assess the specifics of the fight more thoroughly, there is a limit to how much time should be allowed to pass, as specifics on the fighter's thought process in the fight will be harder to recall.

FIGURE 86.1
SUMMARY OF KEY POST-FIGHT REVIEW QUESTIONS



TECHNICAL

In a technical post-fight review, the fighter and MMA coaches (e.g., the team that cornered the fight) re-watch the fight to identify things the fighter did well and things that can be improved. It should be noted that if the corner team are not the people that set up the fighter's training and fight-camp, then the coach responsible for this should also be part of the post-fight review. The fight itself can be broken down many different ways. However, for the purpose of the technical review, we suggest five key areas: i) technical, ii) tactical, iii) physical, iv) psychological and v) communication between corner and fighter. A sample questionnaire that addresses these five key areas is provided in Table 86.1. This questionnaire is meant to serve as a simple starting point for coaches and fighters to begin to identify parts of the fight and preparation that may need improvement.

TABLE 86.1
SAMPLE QUESTIONNAIRE THAT CAN BE USED IN A TECHNICAL POST-FIGHT REVIEW

I. TECHNICAL

a. How did your skills match up against your opponent?
b. What skill(s) need improvement?
c. What skill(s) could be added to improve your fight performance?

II. TACTICAL

a. Was your game plan accurate? Was the opponent and situation what was expected and prepared for?
b. Were you able to implement your game plan in the fight?
c. How could your game plan have been improved?

III. PHYSICAL

a. How was the duration, intensity and timing of the fight warm-up?
b. How was the technical/tactical focus of the fight warm-up?
c. How was your strength and power throughout the fight?
d. How was your conditioning or work capacity in the fight?
e. Were there any issues with the weight cut and rehydration (e.g., gut problems)?
f. What were your energy levels like? Was your fueling adequate?
g. Were there any injuries that affected you in the fight or fight-camp?
h. Were there any issues with travel?

IV. PSYCHOLOGICAL

a. How was your mindset leading up to the fight and day of the fight?
b. What was your thought process like during the fight?

V. COMMUNICATION BETWEEN CORNER AND FIGHTER

a. Was the cornering process effective? Did fighter and coach understand each other?
b. Did the fighter feel the information/advice given was correct and actionable?

After the fight has been re-watched, it is also a natural time to review the technical aspects of the preceding off-camp and fight-camp. From this, the technical post-fight review can also help decide which skills, techniques or non-technical areas should be given high priority when the fighter returns to training. Below are some of topics that may be included in the technical review:

- Off camp and fight-camp specific drills that the fighter enjoyed and felt were useful in the fight (i.e., drills that transitioned from training to competition)
- The initial technical needs analysis at the beginning of the off-camp and comparison with what the most recent fight indicates
- If the fighter and coaches felt there was any over- or under-training based on the level of arousal and fatigue on fight day
- The fighter's performance in relation to any injury limitations (e.g., if there was any part of the fight-camp or the game plan that could not be implemented due to a specific injury)
- If any injuries from the fight will affect training moving forward

STRENGTH & CONDITIONING

In a similar manner to the post-fight technical review, and in conjunction with the fighter, MMA coaches and other staff (e.g., physical therapist, dietitian), a strength and conditioning coach should conduct a review of the athletes' physical characteristics following competition. This may include questions about the fight, fight-camp, and fight-camp variables. Table 86.2 provides an example of a survey questionnaire that may be provided to an athlete to assess several performance variables. This will provide a subjective look into how well the athlete felt these variables were developed for the fight.

TABLE 86.2

SAMPLE QUESTIONNAIRE THAT CAN BE USED IN A STRENGTH AND CONDITIONING POST-FIGHT REVIEW

I. REFLECT ON YOUR PERFORMANCE AND RATE THE FOLLOWING PHYSICAL QUALITIES:

a. Energy
b. Strength and Power
c. Quickness and Speed
d. Endurance
e. Recoverability

II. HOW DID YOUR PHYSICAL QUALITIES COMPARE TO YOUR OPPONENT?

a. Energy
b. Strength and Power
c. Quickness and Speed
d. Endurance
e. Recoverability

III. HOW EFFECTIVELY WERE YOUR STRENGTH AND CONDITIONING SESSIONS PLANNED TO COMPLEMENT YOUR MMA TRAINING? WERE THERE ANY ISSUES THAT COULD BE IMPROVED?

IV. DID YOU FEEL THE ASSESSMENTS USED AND DIAGNOSTICS FROM THESE ASSESSMENTS HELPED IDENTIFY KEY TRAINING OBJECTIVES? AND WERE THOSE OBJECTIVES MET? IF NOT, WHY DO YOU THINK THAT IS?

In addition to performing a post-fight strength and conditioning review, and if the fighter has not been seriously injured, the days following a fight may be an opportune time to run a performance assessment on the fighter. This is because collecting objective data straight after a fight can allow for a near-peak performance assessment that may not be attainable otherwise. Although assessments can (and should) be performed in the weeks prior to a fight, there are limitations to their implementation especially if fatigue from the test will impact technical training and also what the results convey. For example, high-intensity energy system assessments, such as a VO2 peak, may overly fatigue an athlete, and the demands of a weight descent during fight-camp and fight-week will most likely alter the athlete's true performance capabilities in any late fight-camp assessment. As such, the days following a fight can possibly provide an opportunity to test with fewer limitations. However, this presents its own problems as the fighters may be dealing with multiple issues (e.g., injuries, concussion) and obligations following a fight. Even if a fighter is not injured, the demands of the fight—both physically and mentally—may be so great that the week following is needed for recovery, and no assessments can be performed. However, if the situation presents itself, and data can be safely collected in the days following a fight, this, along with subjective feedback from the fighter, may provide insights into programming for the transition period following a fight as well as the upcoming off- and fight-camp.

SPORTS MEDICINE

Just like strength and conditioning coaches, sports medicine providers should review the injury management of an athlete over the off- and fight-camp phases in collaboration with the fighter, MMA coaches and other support staff. One real-

FIGURE 86.2

CONSIDERATIONS FOR A SPORTS MEDICINE PROVIDER IN THE POST-FIGHT REVIEW PROCESS

EVALUATE FIGHT AND FIGHT-PREPARATION INJURY LIMITATIONS	IDENTIFY THE DRIVER BEHIND LIMITATIONS CAUSED BY THE INJURY ACROSS TECHNICAL AND NON-TECHNICAL TRAINING. WERE THE MANAGEMENT STRATEGIES EFFECTIVE?
POST-FIGHT CLINICAL EVALUATION	ESTABLISH DIAGNOSIS AND MANAGEMENT PLAN. IS REHABILITATION THE PRIORITY IN THE TRANSISTION PERIOD AND NEXT OFF-CAMP?
RE-EVALUATE BASELINES FOR MEDICAL ASSESSMENTS	ESTABLISH FRESH PHYSICAL AND NEUROCOGNITIVE BASELINES. IDENTIFY IMPROVEMENTS AND DEFICITS.
MULTI-DISCIPLINARY REVIEW	CONSENSUS RETURN-TO-TRAINING PLAN IN TRANSITION PERIOD WITH SITUATIONAL LEADS TO ACCELERATE THE FIGHTER'S RECOVERY

If a fighter has been injured in a fight, it is crucial that the following steps are taken in the transition period and return to training:

1. **Rehabilitate: Restore movement, strength and function to the injured area.**
2. **Collaboratively develop movement and strength capabilities in other areas:**
   a. Implement corrective exercises in warm-ups.
   b. Schedule a remedial training session on a recovery day.
3. **Educate the fighter and support team as to the purpose of these exercises.**

world instance in which the sports medicine provider would be central to the post-fight review process is when a fighter has an injury during fight-camp (e.g., landed on an outstretched arm when being taken down). This injury may have caused significant discomfort, and though somewhat manageable throughout the rest of the fight-camp, the fighter loses by knockout. After the fight, the fighter reports that he was unable hold up his guard due to the shoulder fatiguing. In these situations, the sports medicine provider should have a large contribution to the post-fight review, and Figure 86.2 illustrates their requirements as part of this process.

SPORTS NUTRITION

Similar to the other support staff, the dietitian or sports nutritionist involved with the fighter's competition preparation should be involved in any post-fight review. This would involve discussion as to whether the prior off-camp, fight-camp, weight cut and performance during the fight all went to plan from a body composition and fueling perspective—as well as the progressions needed for the fighter to be prepared for the next competition. Table 86.3 provides an example of a considerations that should be covered by a dietitian with regard to nutrition in a post-fight review.


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TABLE 86.3

CONSIDERATIONS FOR A SPORTS NUTRITION PROVIDER IN THE POST-FIGHT REVIEW PROCESS

I. COMPETITION PERFORMANCE

a. Are there any fueling, size and energy intake considerations from competition?

II. MAKING WEIGHT AND FIGHT WEEK

a. Did the fight week weight-making process go to plan?
b. Did you experience any issues with the post weigh-in rehydration plan?
c. Did weight, fueling and hydration status recover at an optimal level by fight time?
d. If not, are there any practical changes that need to be trialed prior to the next fight?

III. FIGHT-CAMP

a. Review all three weight-division fit metrics to identify where any issue (if any) arose
    i. FFM/Wt Div
        1. Reconsider optimal weight division for the fighter.
        2. Is there any need for hypertrophy mitigation?
        3. Fight-day weight to that of the division and opponent.
    ii. Weight-Making Preparedness Score
        1. Nutrition foundation education and best practice
        2. Body-composition optimization tactics (in conjunction with strength and conditioning)
        3. Metabolic issues (see Section 89)
    iii. Weight-Making Risk Score
        1. Preparation in off-camp
        2. Fight-camp weight-descent strategies
        3. Strategies for accepting fights: Review/Discussion

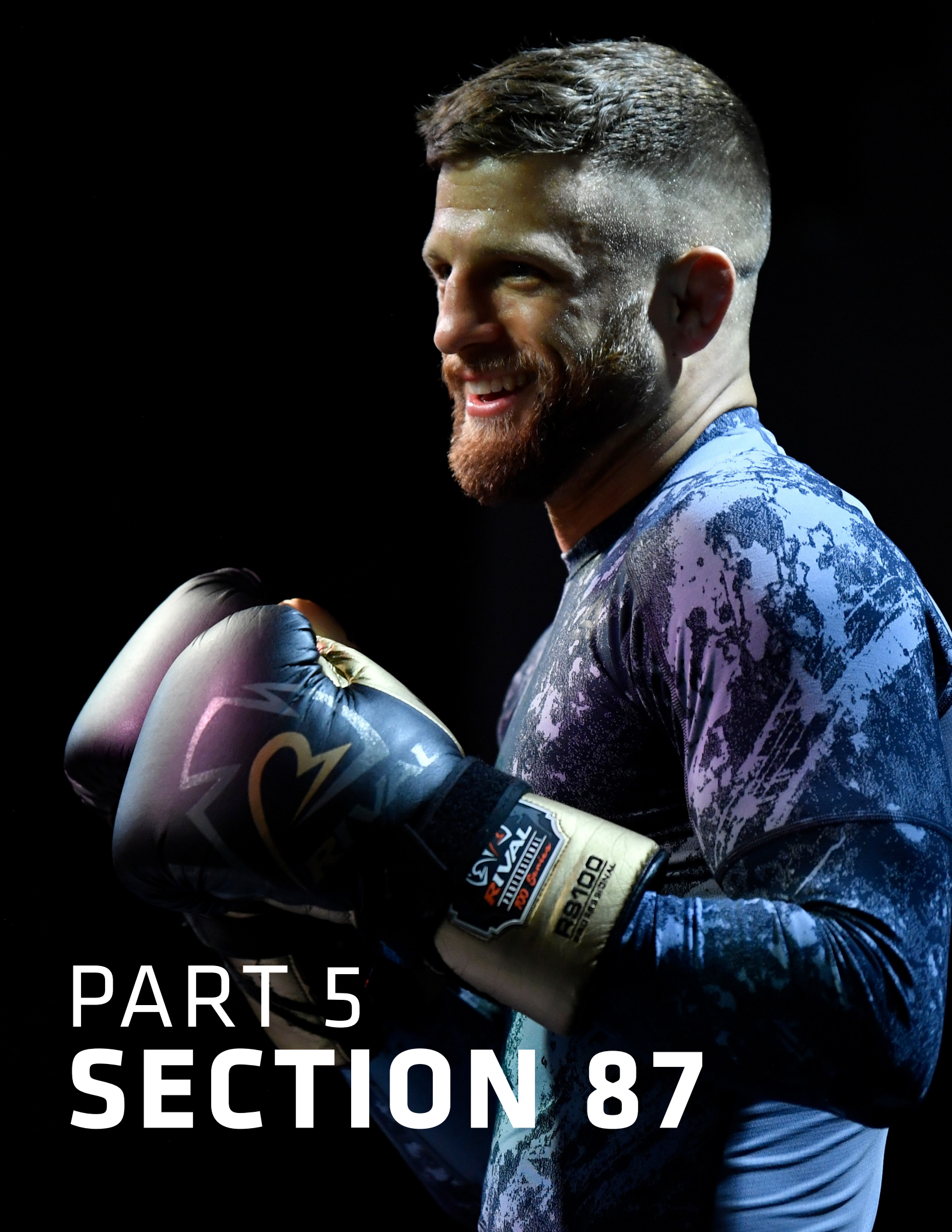
IV. OVERALL FUELING WITH RESPECT TO TRAINING AND RECOVERY

V. GENERAL HEALTH, INJURY (PREVENTION AND RECOVERY) AND ILLNESS CONSIDERATIONS

VI. THE FIGHTER'S FUELING AND NUTRITIONAL EDUCATION AND PRACTICE

a. Time Management
b. Cooking Skills
c. Environmental/Social Support
d. Substance-use Impact on Nutrition
e. Mental Health and Nutrition Considerations (e.g., disordered eating)
f. Metabolic Function
g. Accountability

VII. PLANNING BEST-CASE SCENARIO FOR FUTURE SUPPORT



PART 5
SECTION 87

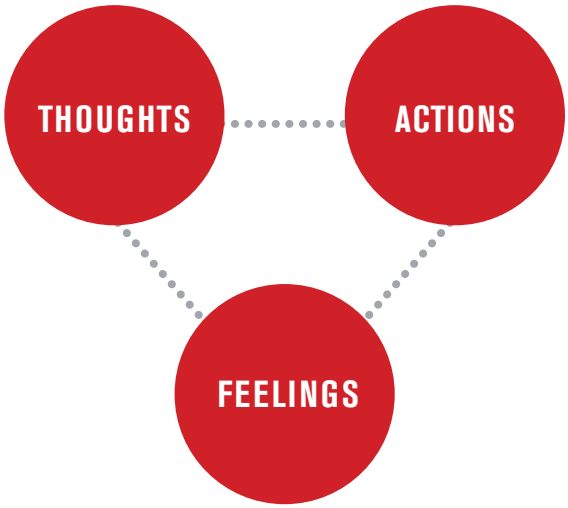
SECTION 87: MENTAL RESET

By Micah Schnurstein and Heather Thanepohn

Fighters can, and will, experience stress and psychological pain from situations in their career pertaining to losing a fight, not meeting individual or coaching expectations, weight management, fitness, health, worry about future fights, opponents they may be fighting, finances, relationships, social media, life outside of fighting and more. Mentally resetting is an effective tool for fighters experiencing stress and psychological pain, which brings attention and focus back to what matters most. This skill can be used in all stages of the fight cycle and supports spending optimal time moving towards identified values and goals. Dr. Amy Saltzman brings attention to how psychological pain includes difficult thoughts and emotions, unpleasant memories and unwanted urges and sensations. Often, fighters can think about this psychological pain, worry about it, resent it, anticipate and dread it. Implementing a mental reset allows fighters to return to the present moment and resume moving on a path that lines up with identified values. Dr. Steven Hayes, creator of Acceptance and Commitment Therapy (ACT), emphasizes that being mindful and paying attention with "kindness and curiosity" to psychological pain allows a mental reset, rather than leading to cognitive fusion (being overwhelmed by challenging thoughts and emotions). It is easy to see only the negative: a failure, a mistake made or a loss; this impacts the ability to get back up, be in the present moment and perform again at the highest level.

Remember:

- Psychological pain is normal, important and all fighters experience it.
- Pain and suffering are two different states of being. Pain is expected, while suffering is continuing to remain in the identified pain after it has occurred—or has yet to occur.
- Trying to avoid or "get rid" of psychological pain only creates more of it.
- Accepting that challenging thoughts and emotions are present will help overcome suffering and move in the direction of present values.
- You can be present and move in valued directions starting right NOW.



THE WAY WE THINK, IMPACTS THE WAY WE FEEL, WHICH IMPACTS WHAT WE DO.

- COGNITIVE BEHAVIORAL THERAPY (CBT)

TIPS TO HELP MENTALLY RESET

- Identify challenging thoughts and feelings that are present
- Stop trying to control challenging thoughts and feelings. You only make more.
- Have acceptance that challenging thoughts and feelings are present.
- Do something that brings awareness to the present moment.
- Move in a direction that lines up with your values.


UFC
UFC



PART 5
SECTION 88

SECTION 88: RETURN TO TRAINING

By Matthew Crawley, Bo Sandoval, Dean Amasinger and Forrest Griffin

The sport of MMA places a rewarding, yet unforgiving, toll on the physical and mental health of fighters. The transition phase after a fight should be used to help offset this toll and address physical and mental restoration from the stresses of competition. This will allow the fighter to avoid overtraining, burnout and future injury, while also minimizing de-training. It is imperative to introduce a transition phase post-fight, which can help enhance performance in the long term. The transition phase can also provide an opportunity for the fighter to improve the athlete-coach relationship (e.g., gaining more understanding of preferred communication style, working on coaching methods that best suit a fighter) and start to establish consistency and commitment with the training program in a positive and purposeful manner.

COACHES TALK

"The return to training mindset should be fun. It is a time to remember that you get to do what you love for money. After I lost to Anderson Silva, I hated the sport and wanted nothing to do with it. At the time, Robert Drysdale was running a Gi competition class, and I did that for about a month. I got smoked by some of the best in the world daily, but I was ok with it because I had no expectation to be good in a Gi. This is how I accidentally got a black belt." — Forrest Griffin, UFC Hall of Famer

POST-FIGHT TRANSITION

Following a fight, it is critical that the fighter has his or her physical damage assessed and receives medical guidance as to when it is most appropriate to return to training. If a fighter is cleared by medical and considered healthy, it is recommended that they participate in a two-week period of active rest, which can include low-intensity alternative exercises and cross-training (e.g., swimming, cycling/spinning, walking, jogging, hiking or yard-work). Win, lose or draw, the fighter should have a plan to re-engage in a routine within this timeline in an effort to limit the effects of de-training and injury. Even if significant injury has been sustained from the fight, efforts to accommodate these injuries and participate in modified training is highly valuable.

REGENERATIVE PLANNING

When planning for the transition phase, it is important to establish strategies and goals for the fighter's program following the period of active rest or reduced training. From a global perspective, training sessions must seek to progressively re-introduce the physical stress with lower work-to-rest ratios that gradually increase to full intensity. Table 88.1 provides example guidelines to manage the return-to-training process. Fundamental areas of planning include the gradual manipulation of training variables such as mode, frequency, intensity, duration and training load (e.g., off-feet to on-feet or MMA conditioning). During the early point in the transition phase, intensity should be low with an emphasis on 50 percent volume, furthermore promoting biological restoration with general physical preparation. Any training sessions (e.g., strength and conditioning) must be programmed and implemented with the athletes' current state of fitness and fatigue in mind. Although these may need to be modified due to injury after a fight, indicative guidelines for a fighter's return to training are detailed in Table 88.1. Other considerations in a fighter's return to training for different disciplines include:

- MMA: Positive reinforcement coaching with low-volume, low-intensity/cross-training exercise (if volume is high due to the nature of the practice, then low density)
- Strength and Conditioning: Active regenerative low-volume, moderate-intensity physical activity
- Performance Nutrition: Metabolic rehabilitation
- Sports Science: Observe ANS trends and minimize technology fatigue
- Sports medicine: Flushing, damage control of injured areas, tune-ups
- Sports Psychology: Mental reset (see Section 87), "clearing" the mind

INTERDISCIPLINARY APPROACH TO THE TRANSITION PERIOD AND A RETURN TO TRAINING

Using an athlete-centered interdisciplinary approach to the return-to-training phase means the fighter's full support team (e.g., sports nutrition, MMA coach, sports psychologist) should collaboratively problem-solve and create a plan that best suits the fighter. As previously mentioned, it is critical for the fighter post-fight to have physical damage assessed and receive medical guidance for a return to training timeline. Although the fighter will normally need rest after a competition, there should be consideration given to maintaining some form of training load in this period. For example, at the UFC PI Shanghai Academy, if fighters do not have serious injuries after a fight, they are requested to engage in a two-week period of active recovery that includes low-intensity physical activity and cross-training but also allows healing of the body and mind. The fighter and performance team

TABLE 88.1

GUIDELINES FOR THE RETURN TO TRAINING POST-FIGHT IN A TRANSITION PHASE

TIMELINE	TECHNICAL TRAINING	STRENGTH TRAINING	PLYOMETRIC TRAINING	CONDITIONING
RETURN TO TRAINING **WEEK 1**	50% REDUCTION IN TOTAL PRACTICE VOLUME	50% REDUCTION IN FREQUENCY, VOLUME, INTENSITY AND 1:4 W:R	<70 FOOT CONTACTS PER SESSION, 1:4 W:R*	50% REDUCTION IN TOTAL PRACTICE VOLUME 1:4 W:R
RETURN TO TRAINING **WEEK 2**	30% REDUCTION IN TOTAL PRACTICE VOLUME	30% REDUCTION IN FREQUENCY, VOLUME, INTENSITY AND 1:3 W:R	<100 FOOT CONTACTS PER SESSION, 1:3 W:R*	30% REDUCTION IN TOTAL PRACTICE VOLUME 1:3 W:R

**ADJUST INTENSITY AS APPROPRIATE*

should de-brief to have a plan structured with a full routine within a specific timeline (dependent on any injuries and/or motivation issues) to limit the effects of de-training and decrease injury risk. An important consideration is the commonality of fighters returning to training from a period of relative in-activity compared to their regular training schedule, therefore any return to training should be systematically progressed in a logical manner. (i.e., not "jump right back into" full training). This progression back to training can be quantified with athlete monitoring tools like sessional ratings of perceived exertion (sRPE). Other athlete monitoring tools (e.g., heart rate variability) can also be used to evaluate the readiness of the athlete on a day-to-day basis and make any changes needed to the return to training plan. Strength, power and energy-system assessments can also be measured during the return to training to help provide a snapshot of the current fitness of the athlete, which can influence programming in the future (e.g., general preparation).



BRICKS=COMPETENCE MORTAR=CONSISTENCY BRICK WALL=CONFIDENCE

TRANSITION OBJECTIVES - THE THREE C'S

The accumulated stress from training and competition in MMA can affect the fighter's physical health and mental health. The transition period becomes a crucial time for the interdisciplinary team to provide a consistent application of integrated professional, interpersonal and intra-personal knowledge to improve the fighter's Three C's: competence, consistency and confidence. The continued development of competence in the transition phase is required to maintain motivation and energy to improve physical capabilities and technical skills in a stress free and relaxed environment. Consistency becomes the mortar in this foundational approach through repeated efforts to refine technical and non-technical skills. To promote confidence, the coaching staff interacts with the fighter in a manner that instills positive self-worth and motivation by providing challenging yet achievable goals that allow them to succeed in growth and development.





PART 5
SECTION 89

SECTION 89: METABOLIC REHABILITATION

By Clint Wattenberg with contribution from Dr. Nikole MacLellan ND

Periods of low-energy availability (LEA), which are commonly seen in a weight descent during a fight-camp, may contribute to metabolic health issues. These issues have previously been defined in literature as Relative Energy Deficit in Sport (RED-s), which may in turn cause other systemic conditions and involve more organ systems, especially with the context of combat sport athletes. There are several biological systems that are involved in a fighter's metabolism, and these are detailed in Figure 89.1. When metabolic health is (or is suspected of being) impaired, this should be addressed as soon as possible to limit any secondary future effects developing (e.g., injury). Indicators of metabolic impairment include difficulty losing weight and making weight, impaired recovery, unexplained weight gain or weight rebounds after a weight-making effort, disordered eating or other psychological issues and menstrual dysregulation (for females), to name a few. Potential strategies for each component of metabolic health are outlined in Table 89.1.

FIGURE 89.1
METABOLIC HEALTH COMPONENTS OVERVIEW

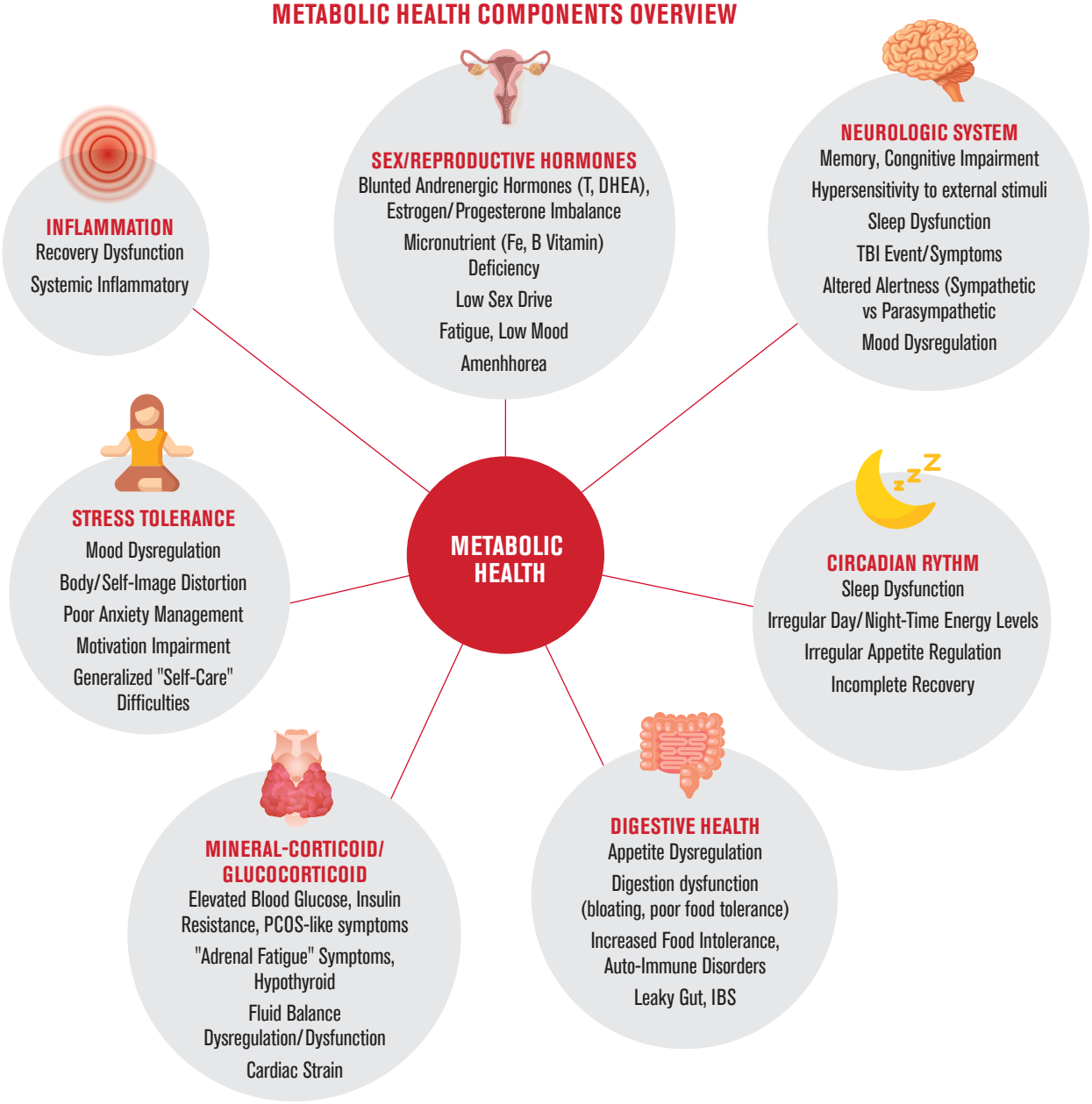


TABLE 89.1

POTENTIAL ASSESSMENT TOOLS AND INTERVENTIONS FOR DIFFERENT COMPONENTS OF METABOLIC HEALTH

METABOLIC "SYSTEM"	SIGNS AND SYMPTOMS OF DYSFUNCTION	ASSESSMENT TOOLS	POTENTIAL INTERVENTIONS
SEX/REPRODUCTIVE HORMONES Low energy availability can result in depression of sex hormones that are critical for training adaptation, recovery and health.	Low sex drive Fatigue, low energy Low levels of testosterone/DHEA Estrogen/progesterone imbalance Amenorrhea Micronutrient deficiency (e.g., Iron, B vitamins)	Bloodwork (e.g., Testosterone, Ferritin, etc.) Subjective fatigue/recovery assessments Menstrual tracking and evaluation	Training volume and intensity adjustments (e.g., increase rest/recovery) Metabolic rehabilitation fueling (See below) Menstrual symptom mitigation Supplementation (e.g., specific micronutrients and adaptogens)
NEURAL SYSTEM Brain injury can result in damage to the pituitary gland, impacting the hypothalamic-pituitary axis (HPA) and all associated metabolic pathways, making neural assessment and recovery critical to metabolic health.	Memory/cognitive impairment Incomplete concussion recovery Altered alertness Sleep dysfunction Hyper-sensitivity to external stimuli (e.g., light and noise) Mood dysregulation (e.g., depression, anxiety)	Comprehensive concussion evaluation (as contributor to neural system dysregulation). Autonomic nervous system evaluation (e.g., heart rate variability) Sleep evaluation Mental health screen/assessment	Treat residual concussion symptoms Training volume and intensity adjustments (e.g., increase rest/recovery) Anti-inflammatory fueling and supplementation Sleep training/hygiene Mental health counseling/training (e.g., self-care) Brain-focused supplementation (e.g. creatine, Alpha GPC, Omega-3)
CIRCADIAN RHYTHM Sleep has a bidirectional relationship with metabolic hormones and health.	Sleep dysfunction Irregular day/night-time energy levels Incomplete recovery from training Irregular appetite regulation (e.g., night carb cravings) Hunger hormones (leptin and ghrelin) dysregulation	Sleep evaluation Nutrition evaluation Mental health screen/assessment	Sleep training/hygiene Nutrition (nutritional timing, sleep support supplements) Mental health counseling/training (e.g., Cognitive Behavioral Therapy, relaxation breathing techniques) Supplementation (e.g., melatonin)
DIGESTIVE SYSTEM LEA impacts the maintenance of the digestive system, including the "gut brain," further impacting immune function and metabolic health.	Appetite dysregulation Digestion dysfunction (e.g., bloating, poor food tolerance) Leaky gut, Irritable Bowel Syndrome Increased food sensitivities and intolerances Auto-immune disorders	Nutrition evaluation Food Allergy Testing Auto-immune/inflammatory marker testing (e.g., Celiac Disease, Irritable Bowel Syndrome)	Nutrition (e.g., Low FODMAPS diet, food intolerance elimination diet) Supplementation (e.g., probiotics, L-Glutamine)
MINERAL-CORTICOID / GLUCOCORTICOID Disruption of fluid balance, combined with chronic physical and/or psychological stress, can exacerbate metabolic disorder.	Fluid balance dysfunction Cardiac strain (e.g., unusually high or low resting or exercise heart rate) "Adrenal fatigue" symptoms Elevated blood glucose, insulin resistance, polycystic ovary syndrome (PCOS)-like symptoms	Nutrition evaluation (including hydration) Bloodwork (e.g., Aldosterone, GFR, Urea, Sodium, Potassium) Mental health screen/assessment	Training volume and intensity adjustments (e.g., increase rest/recovery) Metabolic rehabilitation fueling (See below) Hydration practices Mental health counseling/training (e.g., Cognitive Behavioral Therapy, mindful meditation, breathwork)
STRESS TOLERANCE Poor resilience to psychological stressors can be exacerbated by LEA.	Mood dysregulation (e.g., Depression, anxiety, food/body obsession) Body/self-image distortion Poor anxiety management Low/inconsistent levels of motivation Generalized "self-care" difficulties Neurotransmitter dysregulation (e.g., serotonin, dopamine, melatonin)	Mental health screen/assessment Concussion evaluation (related to impact of concussion on mood/mental health) Nutrition evaluation Sleep evaluation	Mental health counseling/training (e.g. Cognitive Behavioral Therapy, mindfulness training). Metabolic rehabilitation fueling (See below) Training volume and intensity adjustments (e.g., increase rest/recovery)
INFLAMMATION Training causes tissue and cellular damage that stimulates a critical inflammatory response that, in a state of LEA, becomes insurmountable.	Poor recovery from training Systemic inflammation Edema and "third spacing" of fluids	Physical therapy evaluation Nutrition evaluation Bloodwork (e.g., CK, IL-6, CRP, Homocysteine) Auto-immune/inflammatory marker testing (e.g., immunofluorescence assay – AFA) Food intolerance testing (e.g., IgG, IgA)	Physical therapy Increase recovery activities Nutrition (anti-inflammatory, metabolic rehabilitation fueling, elimination diet, FODMAPS) Supplementation (e.g., natural anti-inflammatories like fish oil, specific micronutrient and adaptogens)


Reebok



METABOLIC REHABILITATION SUMMARY

While restoring energy availability is vital to repair the various systems detailed above, many MMA and weight-class sport athletes cannot immediately do so, as they are preparing to make weight for an upcoming fight and are unable or unwilling to step away from their fight. In these instances, minimizing LEA is critical to mitigate the negative physiological, and sometimes psychological, consequences. This can be accomplished through targeted nutrition timing, including carbohydrate periodization through metabolic efficiency fueling (See Section 66), and working to resolve the specific system impairment and symptoms in Table 89.1.

The human body is extremely resilient so long as it receives the nutrients, recovery and rehabilitation tools to enable physiological recovery and equilibration. When time becomes available to do so (e.g., a fight camp concludes), time and effort should be dedicated on rehabilitating the LEA status, as well as targeting the underlying system impairment (e.g., mental health consultation related to stress tolerance, sports medicine screen and nutrition support for chronic and acute inflammation) as detailed in Table 89.1. The time required to repair the metabolic dysfunction seen with the LEA varies and is determined by duration and severity of LEA, as well as the type and severity of symptoms. Generally, full resting metabolic rate restoration and weight stabilization as hypercaloric (e.g., 110 to 120 percent estimated daily needs and a balanced meal plan that includes carbs, protein, fruit and/or vegetables and fat in each of the three to four meals per day) for 2-plus months and resolution of most/all symptoms is required to indicate sufficient metabolic recovery for resumption or training and weight-making efforts. Consideration of the ideal weight division for competition is often recommended in cases when an athlete experiences significant metabolic issues.



PART 5
SECTION 90

SECTION 90: REFORMULATING DIRECTION AND OBJECTIVES

By Joseph Coyne

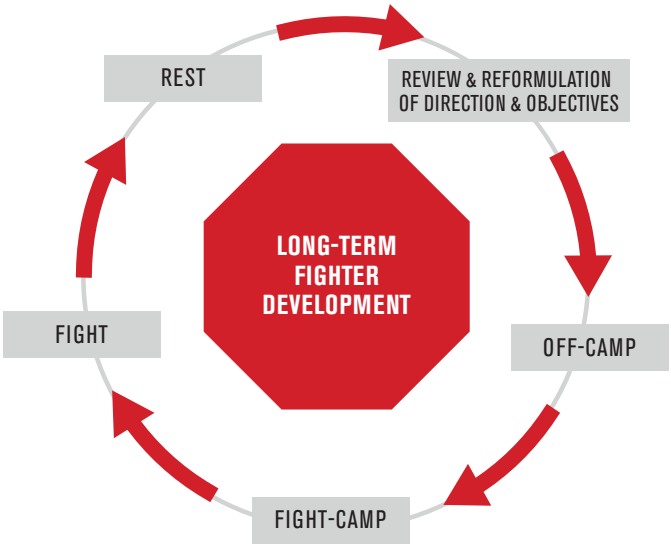
Once the formal review of the previous fight has been completed and the athlete is ready to return to training, there should be a reformulation of the direction and objectives for the fighter. This will start the re-cycling of the athlete into the next fight cycle (i.e., off-camp and fight-camp). This process is detailed in Figure 90.1. The aim of reformulating the direction and objectives for a fighter at the beginning of each fight cycle is to increase the probability of better outcomes in future competition. To do this, athletes and coaches should use the reviews of the fight, fight-camp and off-camp to reflect on what was successful and what could be, or needs to be, improved upon moving forward. This reformulation of direction/objectives will primarily be based off the insights gleaned from these technical and non-technical post-fight reviews (e.g., "What did we do well?" and "What could we improve on?") and the performance services interaction between one another (e.g., "How well did strength and conditioning complement technical training?" or "How well did physical therapy complement the strength and conditioning?").

To ensure any changes in the fighter's direction and objectives are as beneficial as possible for future performance outcomes, it is also a good idea to be aware of any biases that may impact the post-fight reviews. One example is a results bias which is based on research that suggests that losing feels twice as bad as how good winning feels. As such, athletes and staff may unconsciously alter their reviews based upon the fight outcome (i.e., a win or loss). This will normally appear on a continuum from, "You lost the fight so everything we did was wrong. We need to change everything!" to "You won the fight, so nothing can be improved in the program!" To help against biases like this, there might be an opportunity to bring in an external third party to help with the reformulation process for a fighter. This will give another perspective as to where potential improvements in the athlete's preparation for competition may lie and help to remove biased perspectives moving forward.

Alongside the post-fight reviews (see Section 86), the reformulation of the direction and objectives should be influenced by the athlete's strategic advantages and disadvantages in his or her weight division and what it takes to win (WITTW) in that particular weight division (see Section 1). Further, any new methods (e.g., different striking techniques) or technology (e.g., real-time video analysis of technical training) that may be potentially helpful for the athlete should be studied, bearing in mind how these methods or technologies could be practically implemented in future training.

Once all these factors have been considered, reverse engineering is recommended to help guide how the reformulated direction and objectives will be reflected in future training. We recommend two types of reverse engineering approaches that have been suggested by former professional poker player, Annie Duke: i) back-tracking, which includes reformulating the objectives for the fighter and his or her future training based on everything going according to plan in the upcoming fight cycle and oppositely ii) the pre-mortem, by which there is a reformulating of the objectives for the fighter and his or her future training based on everything going wrong in the upcoming fight cycle. This will help prepare the athlete for both best-case and worst-case scenarios in their training (e.g., For when "everything going to plan" and for when "the crap hits the fan."). Once both back-tracking and the pre-mortem have been finalized considering i) the previous reviews, ii) athlete strategic advantages and disadvantages, iii) WITTW and iv) new methods/technologies, the athlete and staff will re-cycle into the next fight cycle with the best possible opportunity to increase the probability of success in future bouts.

FIGURE 90.1
THE VARIOUS COMPONENTS OF THE FIGHT CYCLE



SUMMARY



In its simplest form, the UFC Performance Institute exists to help fighters maximize their individual potential and optimize their performance in the Octagon. To do this, we aim to provide the global MMA community with the most impactful and up-to-date information on the training and preparation for the sport of mixed martial arts. The information contained within the 90 respective sections of this Cross-Sectional Performance Analysis represents the culmination of more than three years of data collection, countless hours of consulting and coaching more than 600 UFC fighters and the collaboration of the collective expertise within the whole UFC Performance Institute team. Nowhere else has such depth of information, such expertise and such comprehensive insight relating to all aspects of MMA preparation and competition been brought together in a single format. It is our hope that the information we have provided will benefit all athletes, coaches and support service providers—regardless of their level or standards—navigate through the challenges of preparing athletes for the world's most demanding sport.

Central to the approach and methods that the UFC Performance Institute advocates is a philosophy of objectivity in order to support the ability to make empowered decisions that accurately and intentionally meet the exact needs of an individual fighter, against a backdrop of the many different factors that must all be considered for MMA. We promote evidence-based practices that have proven efficacy within all the respective fields of skill acquisition, physiology, medicine, dietetics and much more. However, we never overlook the importance of the respective nuances of MMA and how coaches aim to get their fighters to competition in the most prepared fashion possible, and that may involve many psychological and physiological methods that are more endorsed by personal philosophy and years and years of experience in the trenches (i.e., coaching intuition). The UFC Performance Institute always seeks to blend the "art" with the "science" in such a way that individual approaches and coaching methods can still be at the core of any athlete's preparation, but that the information and perspective we offer we can support this approach with data, insights and expertise that serves to reinforce appropriate decision-making at critical times in an athlete's fight-cycle. Indeed, we see the role of the UFC Performance Institute as complementary to the tactical and technical approach of each and every athlete. We do this by providing all the respective information and insights necessary to make intentional decisions, and then athletes and coaches, including those in our own UFC Academy, can essentially choose the information that they wish to align with more closely for their benefit.

In reflecting upon his time as a fighter, our UFC Hall of Famer and Vice President of Athlete Development, Forrest Griffin, provided the following thoughts:

"During my time at the UFC Performance Institute, I have come to understand the power of data capture, comparison, analysis and strategy. As an athlete, I always avoided comparing myself to others with justification that every fighter has a special blend of physiological, technical and psychological tools that make them a "one of one." While this is an absolute truth, one must not let that detract from the power of "gap analysis." What I mean by that is once the technical and physical characteristics that contribute to success in mixed martial arts have been identified—which the UFC performance Institute has done—one must compare himself to the population as a whole to identify what he excels at and what he needs to improve. This can also help a fighter decide which fighting strategy (i.e., striking, grappling, wrestling) best suits his physical attributes and abilities."

It has been a journey of discovery for every member of the UFC Performance Institute during the past three years of our operations, and in collating all our respective insights, we have arrived at where we are today: the Cross-Sectional Performance Analysis and Projection of the UFC Athlete: Volume Two. We do hope your journey through this information has been as interesting, as informative and as enjoyable as ours has been for the past three years. We truly hope the information contained here gives you the ability to reflect on your current approaches and align them with "best practice" for the sport of MMA. We are excited to share all this content and information with you, knowing that we have provided the most novel and contemporary insights available today in addressing all aspects and considerations for the sport that we all love. The best thing is, while this information is the culmination of three years of work, we're just getting started!

From all of us on the UFC Performance Institute team, we want to thank you for your ongoing support and interest.



UFC PERFORMANCE INSTITUTE

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